



E S S A Y S

M E D I C A L

A N D

E X P E R I M E N T A L .



ESSAYS

MEDICAL

AND

EXPERIMENTAL

E S S A Y S
MEDICAL AND EXPERIMENTAL
ON THE
Following SUBJECTS,

V I Z.

- I. THE EMPIRIC. { Or, Arguments for and against the
II. THE DOGMATIC. { Use of Theory and Reasoning in
 Phyſick.
- III. Experiments and Obſervations on Aſtringents and Bitters.
- IV. On the Uſes and Operations of Blifters.
- V. On the Reſemblance between Chyle and Milk.

B Y
THOMAS PERCIVAL, M. D. F. R. S.

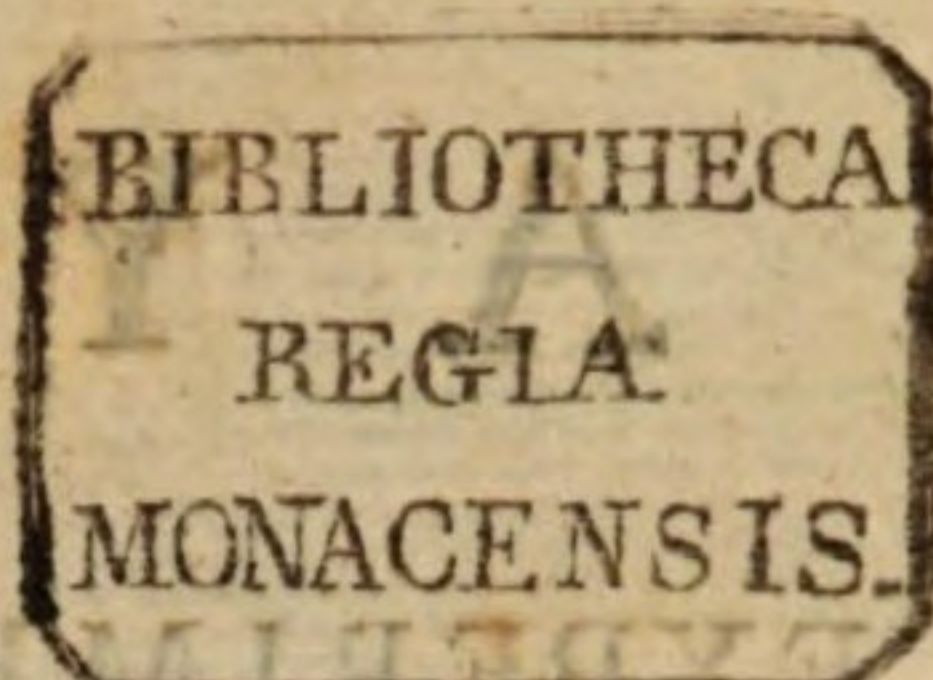
—NE VITAM SILENTIO TRANSEAT.

SALLUST.

L O N D O N :

Printed for T. LOWNDES, N^o 77, in Fleet-ſtreet.

M DCC LXX.



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BY

THOMAS PERCIVAL, M.D. F.R.S.

—IN VITAM BILIBIO TRANSLAT.

244.1.1.1.1.1.

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Printed for T. Lowndes, No. 7, in Fleet-street.

MDCCLXX.

T O

Nathan Alcock M.D.

FELLOW OF THE ROYAL
SOCIETY, and of the
COLLEGE of PHYSICIANS
in LONDON.

SENSIBLE, dear Sir, of
the advantages which
I have reaped from your
friendship and patronage, I
cannot hesitate a moment, to
whom I ought to inscribe
this small volume of Medi-
cal and Experimental Essays.
And I consider it as equally
my

vi DEDICATION.

my honour and felicity, that you permit me to offer it to the public under your *auspices*. I flatter myself that an undertaking which you encourage, will at least meet with a candid, if not a favourable reception from the world. But however this be, I have the satisfaction to think, that I shall be justified by the motives, if not by the success of my publication. For I can truly say, with the honest and benevolent Dr. Sydenham, *Quanta cunque*

DEDICATION. vii

cunque fuerint aliorum conamina, semper existimaui mihi vitalis auræ usum frustra datum fore, nisi et ipse, in hoc studio versatus, symbolum aliquod, utcunque exiguum, in commune medicinae ærarium contribuere.

PERMIT me, dear Sir, to hope, that you will still continue to honour me with your friendship; and believe me to be

Your much obliged,

And most obedient Servant,

THOMAS PERCIVAL.

DEDICATION

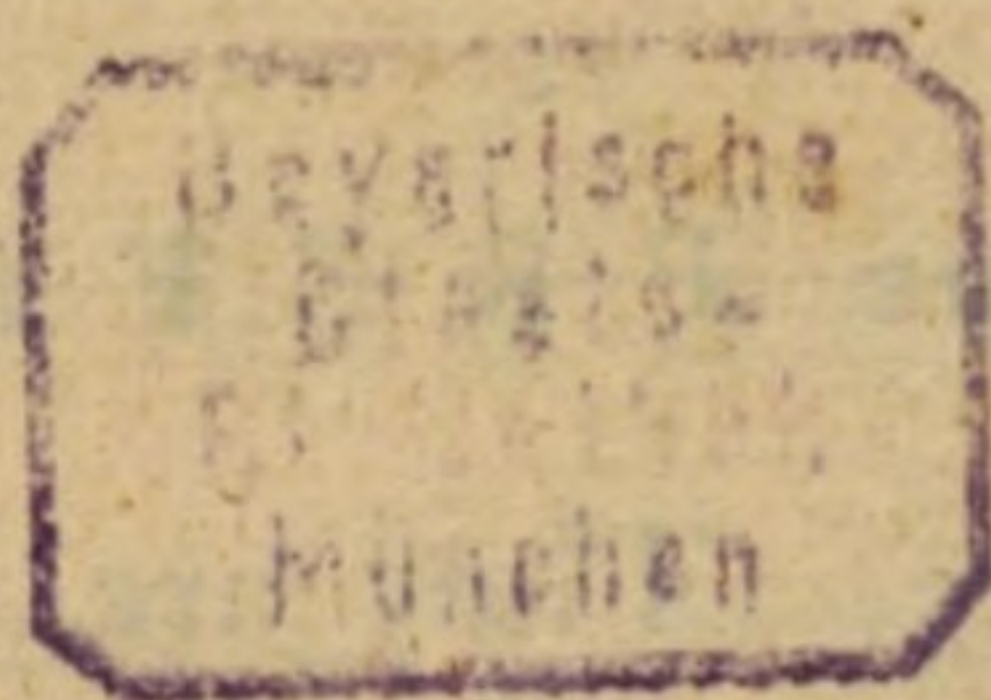
I dedicate this book to
those who have
given me the
pleasure of their
friendship and
the opportunity
of their criticism.

Permit me, dear Sir,
to hope that you will
find no fault with
your friendship and
me to be

Yours most obliged,

And most obedient

J. H. P.



T H E

P R E F A C E.

THE Author of the following
Essays offers them with the
utmost diffidence to the
public inspection. They are the pro-
ductions of his leisure hours, and
were most of them written with a
view only to his private entertainment
and improvement. The first and
second Dissertations contain a discus-
sion of the arguments for and against
the use of theory and reasoning in
medicine.

medicine. They are not intended as an explanation of the tenets of those two ancient and celebrated sects of physicians the Empirics and Rationalists, of which CELSUS hath given us so elegant an account; but to point out opinions which now prevail in the world, and which naturally arise from the different lights in which the same subject is viewed by different minds. The author hath endeavoured to suppose himself first of the one party and then of the other; in order more fully to enter into the sentiments of each, and by that means to do justice to both sides of the question.

THE third Essay consists of experiments and observations on Bitters
and

and Astringents in general, and on the Peruvian Bark in particular. The utility of this method of inquiry is universally acknowledged; and nothing can tend more to the advancement of real science than the steady pursuit of it. The improvements which have been made in the art of medicine for this century past, are more than equal to those of a thousand preceding years: And these improvements may be justly ascribed to that taste for experiment which hath of late so generally prevailed. But though much hath already been done in this way of investigation, there are still numberless untrodden paths in physic which remain to be explored. And every person

person of tolerable abilities, who hath patience, assiduity, and a sufficient minuteness of attention, may almost assure himself that his labours will be rewarded with success, and that he can hardly fail of adding some new and useful discoveries to the common stock of medical knowledge. *Multum egerunt qui ante nos fuerunt, sed non peregerunt: multum adhuc restat operæ, multumque restabit; neque ulli nato post mille sæcula præcidetur occasio aliquid adhuc adjiciendi. (a)*

THE title of the fourth Essay fully explains the purport of it. An attempt to ascertain the use and operation of a remedy so well known as
Blisters,

(a) Seneca.

Blisters, may at first view appear to be unnecessary. But a more attentive examination will convince us of our mistake. The triteness of the subject is the reason that it has been so much over-looked and neglected; and though vesicatories are employed and recommended by almost every medical practitioner, yet few have attended to their real action, and still fewer perhaps to the general principles which ought to direct their application.

THE subject of the fifth Essay, the author candidly confesseth, is rather curious than useful, of more importance to the inquisitive physiologist than to the practical physician.

But

But as all researches into the operations of nature merit our notice and regard, an inquiry into the resemblance between the chyle and milk, hath certainly some claim to our attention. And if it appear probable, as he presumes it will, that milk is the chyle unassimilated or at least very little changed, it may lead to some useful inferences concerning the proper diet for nurses.

ESSAY

E S S A Y I.

T H E

E M P I R I C.

O R,

ARGUMENTS AGAINST THE USE

O F

THEORY AND REASONING

IN PHYSIC.

Sufficit si quid fiat intelligamus, etiamsi quomodo quidque fiat ignoremus.

CICERO.

Non fingendum aut excogitandum sed inveniendum quid natura faciat aut ferat.

BACON.

ESSAY I.

THE

EMPIRICAL.

IN this polished age when every art is advancing towards perfection, and every science enlarging its boundaries, it is a melancholy consideration that MEDICINE should alone be left behind in the general career of improvement. The mists of ignorance and error are now vanishing before the lights of genuine philosophy; and knowledge, practical and speculative extends its influence even to the meanest mechanic. But the Hippocratic art, amidst this rapid and almost

B

universal

universal revolution, is at least stationary, if it move not in a retrograde course. And what is singular in its fate, the same causes which have promoted the advancement of the sister sciences, have by a wrong direction checked the growth and retarded the progress of one which is

—— fairly worth the seven.

POPE.

THE industry of its professors, by an injudicious application, hath served only to darken and perplex it. Instead of patiently treading in the sure steps of EXPERIENCE, they have followed the false clue of THEORY; and whilst with infinite pains and labour they endeavour to penetrate into the recesses of of physic, they have lost themselves in the labyrinths of error. Unhappily for the healing art, their mistakes have coincided with the common propensities of mankind, who are more inclined to
search

search after hidden and undiscoverable causes, than to attend to the obvious phenomena of nature. Blinded with their own fictions, these wanton theorists conceal their ignorance from themselves and the world by unmeaning terms and pompous phrases.

*“ Omnia enim stolidi magis admirantur
amantque*

“ Inversis quæ sub verbis latitantia cernunt.”

LUCRETIVS.

BUT descending from the flights of declamation, let us point out the folly, detect the fallacy and trace the dangerous consequences of theory and reasoning in medicine.

WHOEVER searches into the annals of physic cannot fail of being astonished at the almost infinite variety of systems and hypotheses which at different times have been obtruded on the world. The amazing fertility of the imagination is

there displayed in its full extent; and perhaps so ample an exhibition of the powers of human invention might gratify the vanity of man, if the agreeable effect were not more than counter-balanced by the humbling view of so much absurdity, contradiction, and falshood. The idlest opinions have had their abettors; the most groundless fictions have been swallowed with credulity. A list of all the follies which at different periods have been established as articles of faith in medicine, would form the severest satyr on the healing art. Who can withhold his laughter when he reads of innate heat and radical moisture; of expelling, attracting and concocting faculties; of energies, sympathies, antipathies, idiosyncrasies, and occult causes; of the body being nothing but salt, sulphur, and mercury; of man being a microcosm, and uniting in his frame the motion of the stars, the nature of the earth, of water, air, all vegetables and minerals, the constellations

stellations and the four winds. Yet ridiculous as these several tenets may appear, they have given rise to sects, have been espoused with warmth and defended with acrimony. But the excentric genius of the theorists hath not been confined within the limits of physiology and the laws of the animal œconomy: the hidden causes of diseases, the elements or first principles of medicines and their secret mode of action on the body, have afforded another no less extensive field for the exercise of their creative imaginations. The bare recital of their fictions, would sufficiently demonstrate their absurdity. But to enumerate them would be an almost endless task. Erasistratus defines disease to be a translocation of blood from the veins to the arteries; whereas Galen asserts that as health consists in the equilibrium between dryness and moisture, heat and cold; sickness must depend upon the subversion of that equilibrium. One sect adopts plethora as the cause of all diseases;

another denies the possibility of its existence in the body. Sylvius exults in the discovery that an acid is the sole morbid principle; his antagonists ascribe that honour to their alkali. Salt, sulphur, acrimonies, caustics, volatiles, ferments, &c. &c. have each at different times and by different systematics been received as the undoubted *principia morborum*. No less absurd are the fictions of the theorists concerning the elements and qualities of medicines and their operation on the body. The same drug is represented as hot in one degree and cold in another, or as dry in one proportion and moist in another. Certain remedies are whimsically assigned to particular parts of the body, on which they are supposed to exert their effects by a peculiar predilection. Hence the classes of pectorals, stomachics, hepatics, cephalics, cordials, &c. One medicine attracts and eliminates the bile, another the pituita, and a third the atra bilis or melancholy. Some preparations *irradiate* the animal spirits, others

others *darken* and *obscure* them. But enough of these idle conceits, the offspring of theory and the disgrace of physic.

PERHAPS it may be objected, that though many vain and groundless hypotheses have been advanced, there are two which will bear the test of ridicule and which have had the suffrages of the wisest and most learned men in their favour. Let us briefly examine their pretensions to credibility.

I. GEORGE ERNEST STAHL, a German physician, of a subtil and metaphysical genius, supposes two opposite principles or propensities in the human frame; one constantly and uniformly tending to corruption and decay, the other to life and health. The former is founded on the elementary composition of the body, the latter depends on the power and energy of the mind. By means of the nerves, the influence of the mind is extended to every part of the system, and if their action be impeded, disease is the

unavoidable consequence. A superabundance and spissitude of the blood is therefore the proximate cause of sickness, as the energy of the mind is thereby diminished and its action on the body obstructed. Hence to lessen the quantity and break down the lentor of the blood, the soul exerts all its powers and excites hæmorrhages, sweats, diarrhæas, fevers and the like. Dr. Porterfield and Dr. Nichols have carried this theory still further. The latter in his prælection *de anima medica*, affirms without reserve, that the soul at first forms the body and afterwards governs it, that she regulates and conducts all its vital and natural motions, circulates the fluids and distributes them to the different parts of the system with such velocity and in such proportion as she judges right, and that whenever the body is disordered she excites those conflicts and commotions which are best adapted to restore it to health and soundness.

SUCH

SUCH are the principles of the Stahlians. —Let the unprejudiced judge whether they need a serious refutation. Could a mariner plan and construct a ship, launch it into the wide ocean, govern it in storms, direct it from shoals and rocks and steer it safe into the destined harbour, without being conscious of the skill he exerts and the labour he employs? The analogy is obvious; and it would be equally absurd to suppose that the mind could form the body, regulate all its motions, superintend its health, rescue it from disease and be perpetually occupied in planning and executing the wisest designs, without the least knowledge or consciousness of the power and energy she every moment exerts.

BUT the first proposition of the Stahlians confutes itself. For if the body and mind with equal force be constantly and uniformly tending different ways, no change can possibly ensue: agreeable to the well known axiom in physics, that
action

action and reaction are equal, and destroy each others effect. Not to insist however on this error in philosophy, the doctrine of the Stahlans in confining all diseases to lentor and plethora is false and absurd. The dropfy, scurvy, cachymia, pthifis pulmonalis, putrid fevers and many of the nervous class of ailments, are accompanied for the most part with a thin and colliquated state of the fluids. Nor is there more truth in the assertion, that every distemper is an effort of the mind to relieve the body. The slightest laceration of a tendon has been succeeded by the locked jaw, convulsions and death. An indolent glandular tumour terminates not unfrequently in a cancer. A neglect to evacuate the bladder in due time hath occasioned a suppression of urine; and the palsy has been the consequence of a profuse hæmorrhage. Are these then the wise conflicts of the soul to rescue her suffering partner from impending evil! and must we

we view in the same light the angina maligna, the tussis convulsiva, the spasmodic cholick, the tetanos, cataleptis, worms, rickets &c. &c. No one but a theorist, blinded with the mists of his own brain would answer in the affirmative.

2. THE important discovery of the circulation of the blood in the beginning of the last century by the ever memorable Dr. Harvey, gave rise to the introduction of MECHANICS into medicine. And as that system of philosophy was founded on the general laws of nature, it was obvious to infer its application to the human body; which was supposed to differ only from the universe of things in the wonderful variety and complication of its machinery. Bellini, Borelli, Pitcairn, Keil and Boerhaave are the great supporters of this theory. According to the description of the latter, the body is chiefly composed of a conic, elastic, inflected canal, divided into similar lesser ones proceeding

proceeding from the same trunk, which being at last collected into a retiform contexture, mutually open into each other and send off two orders of vessels, lymphatics and veins, the one terminating in different cavities of the body, the other in the heart. These tubes are destined for the conveyance of the animal fluids; in the circulation of which life consists, and on whose free and undisturbed motion health depends. *Obstruction* therefore is the proximate cause of all diseases. And as it is produced either by a constriction of the vessels or by a lentor in the blood, these are considered as the remote causes.

HOWEVER plausible this theory may appear to be at first sight, it will be found on a stricter examination to be fallacious and defective. The mathematician who calculates the projectile force of the heart, the velocity of the blood in the arteries and the various secretions of the glands, from the known laws of fluids in motion
and

and the nature of tubes of different shapes and sizes, must unavoidably be exposed to a thousand mistakes. The vessels of the body are too numerous and minute to admit of an accurate mensuration; and they are perhaps every moment undergoing changes from the diversified action of that vital power which animates our wonderful system. Hence arises the contrariety in the computations of philosophers on this subject. Borelli reckons the resistance which the heart overcomes in propelling the blood through the arteries and veins to be equal to 180000 pounds weight: Dr. Hales makes it amount to no more than 51 pounds; and Keil, though he computes the fluids of the human body to be five times more in quantity than Borelli supposes, hath reduced the sum to a single pound. A similar diversity appears in the conclusions of the mathematicians concerning the quantity of bile separated by the liver. To determine this point Borelli first
measures

measures the diameter of the *ductus communis choledochus*, which he finds to be the 225th part of the diameter of the *vena cava*, just before it enters the right auricle of the heart. Hence he infers that if 7680 pounds of blood (supposing the whole mass to be twenty pounds, and to circulate sixteen times every hour) passes through the *vena cava* in twenty four hours, the 225th part of this quantity, i. e. thirty four pounds of bile must in the same space of time be transmitted through the hepatic ducts: a conclusion altogether repugnant to fact and experience. And it will appear to be much more so, if we admit with the later mathematicians that the vessels of the human body contain at a medium thirty pounds of blood; for then the quantity of bile, according to Borelli's method of reasoning, must amount to eighty five pounds in one day. But in this, as in the former instance, Keil widely differs from Borelli, and with greater probability concludes that two drachms

drachms of bile and no more, are hourly separated from the liver. In these calculations no attention is paid to the peculiar nature of the animal fluids. Water and wine, a poisonous and wholesome liquid, are governed by the same hydraulic laws, but their effects when circulating in the body would certainly be very different. We know from experience that the velocity of the pulse is influenced by the state of the blood. Even the accession of new chyle after each meal, quickens the action of the heart and arteries. The human body therefore is not to be considered as a mere machine; and that theory which is built on this foundation is evidently fallacious. (*a*)

BUT

(*a*) In the Philosophical Transactions there is a table in which the several purgatives and emetics commonly in use are enumerated and adjusted by mathematical rules to all ages, sexes and constitutions. The doses of the medicines are as the squares of the constitutions. And in the Edinburgh Medical Essays there is a formal attempt to correct the errors of this table.

BUT the mechanic hypothesis is also inadequate and defective; for the animal frame is incident to numberless diseases which have no dependence on obstruction. The *morbi fibræ debilis et laxæ* are not even by Boerhaave himself ascribed to this cause. The dropfy, scurvy, putrid fevers, small-pox, measles, and lues venerea, are inexplicable on mechanical principles. The hydrophobia seems to be entirely a nervous affection, and cannot with the least propriety be supposed to arise from obstruction. No inflammation is observable on dissection in the fauces or gullet; nor is there any palsy in the muscles subservient to deglutition. A numerous class of diseases depend upon that sympathetic connexion which subsists between different parts of the body. When the stomach is out of order, languor, debility, watchfulness, the night mare, and sometimes a cephalæa, vertigo or hemi-crania are the consequences. A rough bone stimulating the nerves of the great toe,

toe, hath produced epileptic fits. And it is well known that Children from the irritation of the gums in dentition are liable to vomiting, purging, fever and convulsions. These few instances are sufficient to shew that the body is unhappily subject to many disorders besides those which proceed from obstruction. And perhaps the conclusion may be carried still further, when we consider that in the operation for the aneurism a large artery is tied up, and the circulation of the blood for some time almost totally suppressed in the part, without any material injury to health. Morgagni relates that Valsalva affixed two ligatures to the carotids of a dog, who lived above twenty days after the operation, and might have continued longer if he had not been killed for the purpose of dissection. Is it then to be supposed that the obstruction of a few capillaries, which are united together by an infinite number of anastomosing branches, can be productive of such fatal consequences,

C

sequences, whilst the course of the blood is stopped in large vessels with impunity? Equally false and absurd is the mechanical hypothesis concerning the operation of medicines, which is supposed to depend upon the size, figure and gravity of their constituent particles. Thus chalybeates, for example, are recommended in obstructions of the catamenia on account of the momentum which they communicate to the blood. And on the same principles mercury is said to break down the texture and produce a colliquation of the animal fluids. But both these explanations however elegant in theory, are false in fact. From the experiments of the late Dr. Wright (*a*) it is evident that steel never enters the lacteals, and that it exerts its effects solely on the stomach and bowels. And it is surely beyond the bounds of credibility to suppose, that a grain or two of corrosive sublimate, which is light enough to

(*a*) Phil. Transf. Vol. 50. pt. 2. p. 595.

to be suspended and dissolved in brandy, is capable by its extraordinary weight of dissolving the crassamentum of the blood. But it is the genius of theory to dignify trifles, and to ascribe the most wonderful effects to the most insignificant causes.

HAPPY however had it been for the world, if the medical systems which have been obtruded on it were only chargeable with inutility, absurdity or falsehood. But alas! they have misled the understanding, perverted the judgment, and given rise to the most dangerous and fatal errors in practice. A short view of the history of physick will convince us of this melancholy truth. The divine Hippocrates knew how to distinguish between theory and experience; and he suffered not his doctrines of fire and water, his elements with their powers, nature with its inclinations, aversions, attractions, repulsions and ratiocinations, to influence his

C 2

treatment

treatment of diseases. But the conduct of his successors was widely different.

ERASISTRATUS reasoning on false and precarious principles, and neglecting experience, the sole test of utility, proscribes the use of venæsection and purging and condemns them as remedies equally infamous and dangerous.

ASCLEPIADES, from whom the modern sect of mechanics have borrowed many of their doctrines, supposing that health depends on the just proportion between the pores of the body and certain corpuscles they are destined to receive and transmit, and that it is impaired whenever these corpuscles are obstructed in their passage, orders exercise on horseback in the most ardent fevers. He advances it as a maxim, that one fever is to be cured by raising another; and that the strength of the patient is to be exhausted by watching and the endurance of thirst. And his
practice

practice was strictly and severely conformable to his principles ; for he would not allow the sick to cool their mouths with a drop of water during the two first days of the disorder. But he indulged his phrenitic patients in the use of wine, even to intoxication.

THEMISON the disciple of Asclepiades rejected some of the opinions of his master, and founded a new sect called the Methodics. But his practice did not materially differ from that of Asclepiades, and his success is recorded by Juvenal in the following line.

" *Quot Themison agros autumnno occiderit uno.*

GALEN for the most part followed the plan of Hippocrates in the treatment of diseases. But as the *materia medica* in the course of five hundred years had been much augmented, the prescriptions of

Galen were devoid of the Hippocratic simplicity. And it is more than probable that his false and ridiculous theory concerning the primary qualities of hot and cold, dry and moist, led him into dangerous errors in the composition of medicines.

ORIBASIUS, Ætius, Alexander Trallianus, Paulus Ægineta, and their successors the Arabian physicians, attempted no material innovations, but humbly trod in the footsteps of Galen. The Arabians indeed introduced several new and valuable medicines into practice, such as manna, fenna, tamarinds, cassia and rhubarb. And by the cultivation of chemistry they laid a foundation for the greatest and most important revolutions in the art of medicine. I omit the mention of Albertus Magnus, Arnoldus de Villa Nova, Raymond Lully, Johannes de Rupefcissa, Isaac and John Hollandus and Basil Valentine, who were all chemists, many of them
inventors

inventors of *panaceas*, and probably the authors of much mischief. In the beginning of the sixteenth century Paracelsus a native of Switzerland stood forth, and with matchless arrogance and the most supercilious contempt of others, proclaimed his opinions to the world. Seated in his Professorial chair at Basil, he solemnly burnt the writings of Galen and Avicenna, intending to become himself the sole oracle in physick. But his theory is wild, romantic, absurd and dangerous; a ridiculous mixture of magic, astrology and chemistry. The body he says is composed of salt, sulphur and mercury; and in these three first substances, as he terms them, health and diseases consist. The mercury, in proportion to its degree of volatility, produces tremors, mortifications in the ligaments, madness, phrensy and delirium. Fevers, phlegmons, imposthumations, and the jaundice are the offspring of the sulphureous principle; and the cholick, stone, gravel, gout, and

sciatica derive their origin from salt. What fatal errors in the treatment of diseases must such idle notions of their causes unavoidably produce? The medicines which Paracelsus and his followers employed were generally metallic preparations, which in such rash and presumptuous hands, were doubtless frequently pernicious and always dangerous. Their common purge in every disorder was *mercurius præcipitatus*, reduced to pills and made up with the *theriaca* or *mithridate*. About a century after Paracelsus, Van Helmont took the lead in physick; a man of such indefatigable industry that he spent fifty years in torturing by every chemical experiment the animal, vegetable and mineral kingdoms. He was a person of learning and ability, but like his predecessor had the folly of pretending to a universal remedy. (b) By his writings he defended, enlarged

(b) Veteres chemici, quorum interpres est Helmontius dixerunt, in cuprum insitum esse genium metallicum, qui

enlarged and promoted the chemical theory ; and as Sylvius de la Boe, and Otho Tachenius soon after adopted his system, it became almost universal. All the operations of nature in the world at large, as well as in the animal œconomy, were reduced to the laws of chemistry ; and every phœnomenon was accounted for on the principles of fermentation, putrefaction, corrosion, effervescence, solution or mixture. The functions of the body were explained by analogies drawn from chemical experiments. Thus the solution of the aliments in the stomach was ascribed to an acid, because acids were observed to dissolve metals and other substances of the firmest texture. Muscular motion was accounted for by an effervescence and explosion in the imaginary rhomboidal receptacles, resembling the tumults raised by

vix mole corporea, sed tantum irradiatione sanat omnes fere morbos ; et Helmontius dixit, hoc fieri solo attactu tincturæ cupri ad linguam.

Boerhaave de morb. Nervor. p. 764.

by the mixture of an acid and an alkali. The generation of animal heat was imputed to the combination of the acid chyle with a supposed balsam of the blood, because a similar effect is produced by uniting acids with distilled oils. If the acid of the chyle happen to be highly concentrated, and the juices very acrimonious, according to this theory an ardent fever is excited. The cold fit of an intermittent was ascribed to the action of nitre, sea salt, or sal ammoniac in the blood, because these substances were found to refrigerate water in a remarkable degree.

FROM this absurd and groundless theory the practice of the chemical sect was deduced; of which I shall give one memorable and fatal instance. In the year 1669 an epidemic fever raged at Leyden, and carried off more than two thirds of the principal inhabitants of that city. The symptoms which accompanied it were a disordered stomach, vomitings, anxiety, quotidian

quotidian or tertian paroxysms, spots, oozing of blood from different parts of the body, dysenteric stools, fœtid urine, great debility, apthæ and other appearances which indicated a very high degree of putrefaction. But Sylvius de la Boe, who was at that time a Professor in the University of Leyden, ascribed the distemper to a prevailing acid, and attempted the cure of it by absorbents and other medicines of a septic nature; to which injudicious practice we may justly impute a considerable share of that uncommon fatality which attended the progress of this fever. And is it not more than probable that the present practice of giving the *testacea* in acute distempers hath a dangerous and pernicious tendency. If acridities prevail in the *primæ viæ* they will indeed correct them; but with this inconvenience that they generally occasion costiveness. And if they remain unneutralised in the first passages, they will powerfully promote putrefaction, and by concreting

concreting with the mucus of the stomach and bowels prove highly oppressive and injurious.

I HAD almost omitted to mention a theory of the most dangerous tendency, which the chemists adopted from Galen and enriched with many absurd additions of their own invention. They supposed the body to be endued with certain *animal spirits*, as they were called, generated in a manner similar to that of obtaining brandy from wine by distillation. These spirits were considered as the seat of various diseases, particularly of inflammation; and were thought capable of being infected with *something* of a peculiarly deleterious nature. Hence it became a desideratum to expel this unknown enemy out of the system; and as it was observed that acute distempers are sometimes terminated by a critical sweat, it was concluded that the most powerful sudorifics were the best means of accomplishing this desirable

desirable end. This gave rise to the destructive and fatal practice, which soon became universal, of administering heating remedies in diseases of an inflammatory nature: a practice which hath committed greater devastation amongst the inhabitants of Europe, than all the plagues which have visited this part of the globe for many centuries. Sydenham, the English Hippocrates, was the first physician who had understanding and courage enough to stem the rapid and overwhelming torrent: and we are now at last taught by a sad experience, founded on the destruction of thousands of our fellow creatures, that the cooling regimen is alone to be employed in such distempers. The small-pox affords us a remarkable example of the opposite effects of the two different methods of treatment. And the amazing success which hath attended inoculation, as practised by Mr. Sutton in Essex, is a proof, undeniably convincing, of the excellence and safety of the one, and the danger

danger and fatality of the other. So powerful is the action of heating remedies in this disorder, that a single glass of mountain wine given even after the eruption is compleated, it is said will throw out an additional number of pustules.

THE system of Stahl, which succeeded that of the chemists, though false and absurd is not chargeable with any pernicious tendency. As it chiefly relates to the influence of the mind over the body, the doctrine of diseases which it inculcates is simple, and the indications of cure which it furnishes, are few and at least harmless. Thus when the Soul in her efforts to relieve the body runs into excess, and excites an immoderate hæmorrhage, diarrhæa or fever, she is to be checked and restrained. On the contrary when she acts negligently or too feebly, she is to be roused and stimulated to an exertion of her powers. In these instances the conclusions of the Stahlians, though

though deduced from groundless principles, are certainly just, and their practice is supported by experience, the true standard of fitness and propriety in physick.

THE Mechanic Theory, though better supported than the Stahlian, hath a more dangerous influence on the treatment of diseases. Thus, for example, in the management of the small-pox, a physician who is strongly attached to the system of obstruction and regardless of experience, would commit the most fatal errors. As the distemper, according to the mechanical hypothesis, consists in a certain matter thrown off from the blood and locked up in the capillaries of the skin, where being gradually accumulated it forms pustules; he would of course attempt either to disperse it by repeated purging and venæsection, or to promote its passage through the small cutaneous vessels by the most powerful sudorifics. The first method of cure would occasion a sudden
sinking

sinking of the pocks ; the second would render them putrid, confluent and malignant. And thus the unfortunate patient would fall a sacrifice to reasoning and theory. I mean not by this illustration to charge the mechanic sect with having adopted so dangerous a method of treating the disease under consideration. The plan of cure prescribed by Boerhaave is judicious and successful ; but it is a deviation from his favourite hypothesis of obstruction, and is founded on experience and observation. There are however some fatal instances in which the mechanical systematics have regulated their practice by their theory. How many unhappy wretches fell by the lancet, or sunk under the operation of cathartics, in the ulcerated fore throat, till the sagacious Fothergill pointed out the true nature and right management of that disease? It is not long since crude mercury was considered as a *panacea*, and taken universally by the healthy as well as the sick,

sick, to prevent obstructions in the one, and to break down by its gravity those which were already formed in the other. On the same principle, the spirit and salt of hartshorn were exhibited indiscriminately in almost every ailment; for as they colliquate the blood when taken out of the body, it was not doubted but they would dissolve that lentor of the fluids which was, and is still by many, regarded as the most general cause of diseases.

IT is evident then that THEORY is absurd and fallacious, always useless and often in the highest degree pernicious. The annals of medicine afford the most striking proof, that it hath in all ages been the bane and disgrace of the healing art. And as it favours the indolence, flatters the vanity and gratifies the curiosity of man, ever inquisitive after causes, I fear the passion for it will not be easily suppressed amongst the professors of medicine. The invention of an hypothesis

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is a work of no difficulty to a lively imagination; and the fiction by its tinsel glitter never fails to dazzle the ignorant and vulgar. But to watch with close attention the operations of nature, to treasure up a store of useful facts, to learn by accurate observations the diagnostics of diseases, and by unbiassed experience the true method of cure, requires unwearied labour, assiduity and patience, at the same time that it admits of no pompous display of wit or knowledge. The wise however value not genuine science less for her unassuming deportment and simplicity of attire; and the opinion of the ignorant would be unworthy the consideration of a judicious physician, if humanity did not interest him in the concerns of such numbers of his fellow creatures, who unhappily fall under that denomination.

ESSAY

ESSAY II.

THE
DOGMATIC.

O R,

ARGUMENTS FOR THE USE

O F

THEORY AND REASONING

IN PHYSIC.

Η πείρα σφαλερή, η κρίσις χαλεπή.

Experientia fallax, judicium difficile.

HIPPOC.

*Medicina in philosophia non fundata, res
infrma est.*

BACON.

ESSAY II.

THE

DOGMATIC.

THOUGH reason is the most exalted faculty of man, and the source of that high rank which he holds in the universe of God, there is a set of groveling spirits in the world, who vilify the powers of the understanding, and with inverted pride, glory in sinking themselves to a level with the brute creation. Of this class are the EMPIRICS, who have laboured with infinite pains to banish all theory and reasoning from the art of medicine. Experience they affirm is the

sole guide to safe and successful practice ; and fatal is the temerity of such who deviate from the beaten path, and trust in any instance to the direction of their understandings. The proximate cause and hidden nature of diseases are beyond our ken, and it is equally absurd and useless to attempt their investigation. All that is necessary to their cure is plain and obvious, and requires no deep or philosophical researches. We know the ailments to which the human body is incident ; we are acquainted also with a variety of active remedies ; and *use* alone hath taught us to adapt the one to the other. Thus argue the empirics ; with a sagacity adequate to the rank of beings, to which by their contempt of reason they degrade themselves. The subject however is worthy of an attentive examination.

THERE are two methods of acquiring experience in the art of medicine ; one
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by reading, the other by practice. The first opens to our view a wide and almost boundless scene of knowledge, presenting us with the lore of all preceding ages : the last is limited and confined, and furnishes a very scanty harvest of instruction. Both are necessary to form the skilful and expert physician ; but without the concurring assistance of our judgment and understanding, neither of them will be found of any other avail, than to perplex us with uncertainty and to lead us into error.

WHOEVER sits down to study the volumes, ancient and modern, which have been written on the subject of medicine, will be amazed at the multiplicity and confounded with the contrariety of the facts and observations which he meets with. And if he read with no other view than to inform himself of the experience, and blindly to submit to the direction of his predecessors in the healing art, he

will either remain in perpetual doubt and suspense, or will treasure up an indigested mass of contradictory materials, burthensome to his memory and unfit for use. An undistinguishing credulity is in no science so absurd and dangerous as in physic. Here every fact which is advanced should be examined with accuracy and admitted with caution. The histories of diseases are frequently the records of falsehood; at least they contain such a mixture of error and truth, as requires the exertion of reason and an extensive knowledge of the animal œconomy, to separate the one from the other. Still more dubious and uncertain is the therapeutic part of medicine, which hath been subject to all the vicissitudes of fashion and regulated by the follies, prejudices and passions of men. How many *panaceas* have been obtruded on the world, whose miraculous effects have ceased the moment they became known? Every author hath his favourite remedy; and what
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he extols perhaps another may condemn; each pleading in his own behalf the testimony of experience. The annals of physick abound with instances of this kind: thus Hippocrates, Galen, Sydenham and Boerhaave, with numberless other inferior names, are enlisted on the side of venæsection; whilst Erasistratus, Paracelsus, Van Helmont and the Cartesian sect totally banish it from the circle of practice. A similar fate hath attended the other means of evacuation; and purgatives and emetics, at different times, have been strongly recommended or ignominiously proscribed. Antimony was formerly considered as a poison, and its use was forbidden by a publick edict at Rome; whereas now it is employed under various forms, and constitutes one of the most valuable articles of the *materia medica*. The Peruvian Bark soon after its introduction into Europe, met with the most powerful opposition. Numberless mischiefs were ascribed to its operation

ration, and cases recited wherein its effects were said to be obviously pernicious. Even those who thought the most favourably of it, regarded it as a dangerous though efficacious medicine, and never administered it but with caution and reserve. At present it is given in the largest doses, and in such a variety of disorders, that it is become an almost universal remedy. Opium, Steel and Mercury have also undergone their several revolutions, and the most contradictory testimonies may be collected concerning their nature and effects. These few instances (for many more might be adduced) sufficiently prove the absurdity of blindly adopting the experience of *others*; and it will be found on examination that *our own*, without the assistance of theory and reasoning, is no less exposed to uncertainty and error. The diseases to which the human body is obnoxious are so various, and frequently so complicated with each other, that it requires the clearest judgment to distinguish

tinguish them with accuracy, and the nicest skill to treat them with propriety. Their symptoms are to be weighed with attention separately as well as collectively; the temperament, age and sex of the patient are to be considered; and the remote and occasional causes of sickness to which he may have been exposed are to be examined into, before any conclusion can be drawn concerning the genus of the ailment, or the indications of cure. In the application of remedies, regard is to be had to the nature, internal source and period of the distemper, and to the peculiar habit or idiosyncrasy of the sick person. But this implies the exercise of reason, and besides experience requires a knowledge of the structure and functions of the animal frame, of the changes produced in it by disease, and of the powers and qualities of medicines; all which the empiric rejects as visionary and useless. “In a watch every one observes when the finger deviates, but the artist alone
who

who is acquainted with the exquisite structure of the machine, can correct and amend its movements." A constant and diligent attendance on the sick, may instruct us in the external face of diseases, and enable us with some degree of certainty to prognosticate their issue. But without theory and an exertion of our rational faculties, it will never furnish any other than the mere fortuitous means of relieving them. The savage Indian by his accurate observation of natural signs, can frequently foretel those tremendous storms to which America at certain seasons is exposed: But of what avail would this have been in preventing the impending ruin, if philosophy had not accomplished what was impossible to rude experience? To the ingenious Franklin our colonies owe the warmest gratitude, who by investigating the nature and causes of thunder and lightning, hath pointed out the method of warding off their destructive effects. How blind and dangerous

gerous would be all attempts to cure the disorders of the eye, without a knowledge of its structure, and an acquaintance with the theory of vision? And yet the empiric is professedly ignorant of both. Suppose him to be consulted by a patient labouring under the *gutta serena*: no external defect appears, no pain is complained of, and the health of the body in every other respect is perhaps unimpaired. By what signs will he be able to determine the seat of the disease; or upon what principles will he proceed in the treatment of it? Confusion, uncertainty and danger must necessarily attend his random practice. By the laws of the animal œconomy, there subsists a certain sympathy between different parts of the body; by which the disordered state of one organ impairs the functions of another. The head and stomach, for instance, have an almost universal consent with the rest of the system, and of consequence are subject to various and sometimes

times opposite causes of indisposition, each indicating a different and peculiar method of cure. Thus watching, flatulency, indigestion, the gout, rheumatism or inflammation, may produce the head-ach; and sickness or vomiting may arise from surfeiting, from a load of mucus, from putrid bile, from an affection of the kidneys, and from many other sources. In all these cases the empiric, if he act consistently with his principles, will attend only to the leading symptom, and will indiscriminately apply his stomachic cordial or cephalic plaister, without any regard to the origin or nature of the malady.

MAY we not therefore justly conclude, that mere experience, whether derived from books or acquired by personal observation, is insufficient of itself to qualify us for judicious and successful practice. “I look upon a good Physician,” says the amiable Mr. Boyle, “not properly as a servant to nature, but as a counsellor
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and friendly assistant, who in his patients body furthers every thing which he judges to be conducive to the welfare and recovery of it. " To this end a knowledge of the animal œconomy, of the influence of external causes on the human frame, of the state of health, and the changes induced by disease, is absolutely necessary. And this is the foundation on which the dogmatic erects the superstructure of medicine. He explores the writings of the ancients and moderns, he attends diligently to nature in her operations, he selects and arranges facts, and deduces general conclusions, and thus forms a consistent, rational and useful theory on which his practice is built. (*a*) He neither indulges a warm and creative imagination, nor yet confines himself within
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(*a*) Although the arguing from experiments and observations by induction, be no demonstration of general conclusions, yet it is the best way of arguing which the nature of things admits of; and may be looked upon as so much the stronger, by how much the induction is more general.

NEWTON.

the limits of one narrow hypothesis, well knowing the absurdity of either extreme. With the Stahlians he believes that the soul, or nature, as it is now called, frequently exerts herself in the cure of diseases, or in expelling from the body whatever is offensive and hurtful. Thus a *crapula* occasions a *diarrhœa*, and a crumb of bread in the wind-pipe excites a fit of coughing. But he is aware likewise, that the efforts of nature in such cases may be too powerful; that a salutary *diarrhœa* may terminate in a dysentery, and a fit of coughing in universal convulsions. He adopts also, with restrictions, the mechanical and chemical hypotheses, and admits that obstruction is often a cause of disease, and that many changes in the body are reducible to chemical and mechanical principles, of which he deems inflammation and acrimony to be sufficient proofs. But he is not wedded to systems, nor anxiously bent upon explaining every phænomenon which

which occurs in the animal frame. He diligently avails himself indeed of all the assistances with which philosophy furnishes the healing art; but sensible of its imperfection, he ingenuously acknowledges that in diseases there are numberless anomalous symptoms, that the operation of medicines is often irregular and uncertain, and that even in the healthy body there are many appearances, which are inexplicable to the wisest and most experienced of the faculty. But where his theory is deficient, his practice is proportionably more cautious and reserved. If experience fails him, he calls in analogy to his aid (*a*); and judges it better to pursue a doubtful path, than to stand still in uncertainty and suspense. In the most intricate cases however he is not totally without a clue: Reason and philosophy

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(*a*) Ejus (analogiæ) hæc vis est, ut id quod dubium est, ad aliquod simile de quo non quæritur, referat; ut incerta certis probet.

Quiut. Inst. Orat. l. 1. c. 6.

are his guides ; and under such direction there is at least a probability that he will not mistake his course. And by thus treading occasionally in unbeaten tracks, he enlarges the boundaries of science in general, and adds new discoveries to the art of medicine. In a word, the Rationalist has every advantage which the Empiric can boast, from reading, observation and practice, accompanied with superiour knowledge, understanding, and judgment.

ESSAY III.

EXPERIMENTS

AND

OBSERVATIONS

ON

ASTRINGENTS

AND

BITTERS.

Nata est ars ab experimento.

QUINTILIAN.

Felix qui potuit rerum cognoscere causas.

VIRGIL.

ESSAY III.

EXPERIMENTS AND OBSERVATIONS ON ASTRINGENTS AND BITTERS.

EXPERIMENT I.

AN ounce of PERUVIAN BARK coarsely powdered, was divided into two equal parts, one of which was infused forty eight hours in six ounces of cold spring water; the other was boiled over a slow fire forty minutes, in nine ounces of water, till about a third part of the water was evaporated. The infusion and decoction were each filtered through linen rags doubled and of equal fineness,

Four grains of *sal martis* were dissolved in an ounce of spring water, and one

drachm of this solution was added to equal quantities (viz. half an ounce) of the turbid decoction and infusion. Each assumed a deep purple colour, scarce perceptibly different in degree, though I thought the infusion, after standing a while, acquired rather a more dusky purple than the decoction. The infusion had a deeper tinge, and more of the taste and smell of the bark in substance than the decoction: Its taste indeed exactly resembled the bark, after it has been broken down and chewed for some time in the mouth.

EXPERIMENT II.

EQUAL quantities of each *residuum* were boiled over a slow fire in three ounces of spring water, for the space of twenty minutes. The decoctions were equally turbid, exactly similar in taste, and on the addition of the chalybeate solution, in the proportion of one drachm to half an

an ounce, they assumed precisely the same colour, viz. a dusky brown like chocolate, but inclining somewhat to purple.

EXPERIMENT III.

FIVE drachms of each *residuum* were infused for the space of forty hours, in an ounce and half of Jamaica Rum, which was sufficiently pure and unimpregnated with any astringent matter from the cask. The tinctures were exactly alike in taste and colour; and on the addition of one drachm of the chalybeate solution, they were instantly changed from a deep red to a dark and dirty brown, which was precisely the same in both tinctures.

EXPERIMENT IV.

To half an ounce of powdered bark was added an ounce of cold spring water. The mixture was well triturated in a marble mortar, after which it was suffer-

ed to remain at rest till the gross powder subsided. The clear liquor was then carefully poured off, and fresh water to the quantity of half an ounce was added; the trituration was renewed, and afterwards part of the *menstruum* poured off again as before. This method was pursued for the space of thirty four hours, in which time six ounces of water were combined with the bark. The mixture was then infused fourteen hours, without heat, and strained off. This infusion was found to have the smell and taste of the bark, in a considerably greater degree than either the decoction or the infusion without trituration [Exper. I.] and it assumed a much blacker colour, on mixing with it one drachm of the chalybeate solution, than either of the two former preparations.

EXPERIMENT V.

It was attempted to determine the
compa-

comparative strength, or rather astringency, of five preparations of the bark, viz. the extract, decoction, cold infusion, tincture, and triturated infusion.

TEN grains of the extract carefully made, and as free from *empyreuma* as this officinal preparation is generally found to be, were mixed with an ounce of hot water. But so imperfect was the solution, or to speak more properly the suspension of the bark, that in a few minutes a large powder was deposited at the bottom of the glass. This however was shaken up, and one drachm of the chalybeate solution was added to the mixture. The same quantity was added to half an ounce of the decoction, infusion, tincture of the London Dispensatory, and triturated infusion. The last assumed by far the deepest black, the extract approached nearest to it, and the tincture appeared to be the least tinged. The decoction and infusion were precisely alike in colour.

EXPER-

EXPERIMENT VI.

THE *residuum* of the triturated infusion, [Exper. IV.] was boiled over a slow fire in three ounces of water for the space of twenty minutes. The decoction when cold was strained off. It was of a paler colour than the decoctions mentioned in Exper. II. although there was a portion of powdered bark suspended in it, which by the trituration had been rendered fine enough to pass through the filter. This powder on standing subsided to the bottom of the vessel, and left the decoction much more limpid than it was before.

To equal quantities of this and of the two decoctions mentioned above, one drachm of the chalybeate solution was added. The black tinge was manifestly weakest in this decoction, though the difference was not so great as might have been expected from the diversity in their sensible qualities

qualities of taste and smell; owing perhaps to the fine powder of the bark which floated in it, and retained some degree of its original astringency.

EXPERIMENT VII.

EQUAL quantities of the simple and of the triturated infusion, were boiled for the space of seven minutes over a quick fire. Both lost their transparency when cool; but the latter assumed a much more turbid appearance than the former, exceeding even that of the decoction from fresh bark [Exper. I.] and after standing twenty four hours, it deposited a very copious sediment.

EXPERIMENT VIII.

HALF an ounce of powdered bark was infused forty eight hours, in five ounces of spring water and one ounce of white wine vinegar. The mixture was placed
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near a warm fire, and at certain intervals was smartly shaken. It was then filtered through a linen rag doubled. The taste of the vinegar was in a good measure covered, though the smell was not; but the *menstruum* was not so fully impregnated with the flavour of the bark as the infusion [Exper. I.] One drachm of the chalybeate solution was added to half an ounce of this acid infusion; at first no change of colour took place, but in a few hours a slight black tinge appeared.

EXPERIMENT IX.

HALF an ounce of powdered bark was well triturated, in the manner described in exper. IV. with six ounces of warm water; after which the mixture was poured into a bottle, placed near the fire, and frequently shaken. This process lasted forty eight hours. The infusion, when strained off, was found to be more perfectly impregnated with the bark,
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than the triturated infusion with cold water [Exper. IV.] as appeared by comparing their colour, taste, and smell, and by the deeper black which it instantly assumed on the mixture of one drachm of the solution of sal martis.

EXPERIMENT X.

HALF an ounce of powdered bark and two drachms of stone quick lime, warm from the kiln, were rubbed together until they were thoroughly united; then six ounces of spring water were gradually poured on, the powder and water were well incorporated by triture, and the mixture was set by to infuse for twelve hours. Two ounces of it were then filtered through a doubled linen cloth: the remainder stood thirty six hours longer and was often agitated; after which it was strained off. The smell of the bark was almost entirely covered in both the infusions, which were strongly impregnated

pregnated with the lime, and had an extremely disagreeable flavour. The first was of a pale colour, and possessed but a slight degree of bitterness; the latter had a deeper tinge, and was equally bitter and nauseous. Neither of them struck a black colour with the chalybeate solution, which as soon as it was added occasioned the separation of a yellow sediment, which in a few hours subsided to the bottom of the glass. Compared with the triturated infusion [Exper. IV.] these preparations appeared to be much weaker both in colour and taste. The *residuum* did not sensibly effervesce with oil of vitriol.

EXPERIMENT XI.

THE decoction and infusion, were found to be impaired in strength after standing six or seven days; although it was the winter season and the weather was severely cold. The infusion became paler coloured, and at the same time deposited a slimy sediment.

ment. The decoction at the end of seven days assumed an almost milky hue, and struck but a faint black with the chalybeate solution. The simple infusion also had lost much of its astringency; but the two triturated infusions were very little altered in that respect.

REMARKS ON THE PRECEDING EXPERIMENTS.

PHYSICIANS in general agree, that the PERUVIAN BARK is most powerful in its effects when taken in substance. But as the stomach is frequently unable to bear it, and as many patients have an almost invincible aversion to it in that form, it is of importance to determine in what preparations the virtues of this valuable drug are least impaired, and whether it may not be administered under a form that is elegant, palatable, and at the same time sufficiently efficacious. The decoction of the bark hath always appeared to me, to be an
injudicious

injudicious preparation: for though the cortex is not a substance of much volatility, yet there is certain aroma accompanying it, which the heat of boiling water cannot fail to dissipate (*b*); and consequently the medicine is deprived of one of its component parts, in which probably some share of its virtues resides. The bark likewise undergoes a decomposition by boiling; the resin is separated from the gum, and remains suspended in the watery menstruum. This renders its appearance inelegant, its taste nauseous, and, I should apprehend, must considerably diminish its efficacy. For as the virtues of the bark are strongest in its native state, they depend in all probability on its composition as a *mixt*; and must of course be impaired by the disuniting of its constituent principles. By the first, second

(*b*) The vapour which exhales in the first coction, being caught in proper vessels, condenses into a limpid liquor which smells strongly of the bark.

Lewis's Mat. Med. p. 431.

cond and third experiments it appears, that the cortex yields its virtues at least as perfectly to cold as to boiling water. And the simple infusion hath certainly many advantages over the decoction. It is a much more agreeable and elegant preparation, and the principles of the bark remain perfectly unaltered in it, retaining the same proportions to each other as in the substance of the drug itself. Nature hath so accurately combined and blended together the gummy and resinous parts of the cortex, that by their union they become soluble in *menstrua*, with which when separated they refuse to unite. Thus they reciprocally promote the solution of each other in water and ardent spirits; and both the tincture and infusion are found by experiment, to be strongly impregnated with these two constituent principles of the bark. The tincture is without doubt an elegant and palatable preparation; but it is liable to this objection, which indeed

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holds equally true against spirituous tinctures in general, that a sufficient dose of the medicine cannot be given, on account of the heating nature of its vehicle: In nervous fevers, hysterical disorders, and low other cases where it is necessary to join cordials to the bark, an infusion of it in red port wine may be prescribed with advantage. Under this form the famous empiric Talbot used to administer the cortex in the paroxysms of intermittents; and so successful was his practice, that LOUIS XIV. was induced to purchase at a large price the secret of his specific. Orange peel is an useful ingredient in preparations of the bark; it gives a grateful warmth to the infusion, and adds, I think, considerably to its efficacy. The following formula is agreeable to the taste, and well adapted to a weak and delicate stomach.

*R. Pulv. cort. peruv. ʒj. cort. aurant.
ʒ ss. aq. cinnamom. ten. ʒxij. aq. cinnamom.
sp. ʒij. m. et infunde sine calore per ses-
quidiem, deinde cola.*

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THE use of trituration in promoting the powers of solution is evident from experiments IV. VI. and VII; and would have been still more so, if a proper apparatus had been employed. The Count de la Garaye, a French gentleman, who is distinguished for his assiduity in applying the different branches of philosophy to the improvement of medicine, hath described a very convenient machine, and pointed out an admirable process for obtaining from vegetables, by triture with water, the matters in which their virtues chiefly reside. The contrivance is extremely simple, consisting only of a vessel to which a churning staff is fitted, which by means of a cord and a wheel, is perpetually whirled with a rotatory motion. By this constant agitation the most accurate diffusion is produced, and different portions of the *menstruum* are in quick succession applied to every particle of the solvend.

FROM the 5th. experiment no certain

F 2 conclusions

conclusions can be deduced; except that the extract is a much weaker preparation than is commonly supposed. It is liable to all the objections which have been advanced against the decoction, with this additional one, that it is hardly possible to make it according to the process of the London Dispensatory, without giving it some degree of *empyreuma*. The extract employed in my experiment, was prepared by a very diligent and careful apothecary, yet a considerable portion of it presently subsided in a powdery form to the bottom of the glass, which on examination appeared to be the burnt parts of the bark. How little then is this officinal medicine to be depended upon, when we consider the carelessness and inaccuracy of many of our apothecaries?

It is the practice of the most eminent physicians, to join acids with the bark in the cure of putrid diseases; and Sir John Pringle hath observed, that in bilious fevers

vers the cortex answered best in Rhenish wine, after standing a night in infusion. (*a*) This suggested to me the 8th. experiment, and I flattered myself that by macerating the bark in a mixture of vinegar and water, these two antiseptic medicines would be more accurately combined together, and that perhaps the acid might promote the dissolvent power of the aqueous *menstruum*. In the latter expectation it appears that I was disappointed; and whether the former was better founded must be left to abler judges to determine. (*b*)

THAT moderate heat promotes and assists the action of water, as a *menstruum*, on the bark, is evident from experiment the IX; and it would be of advantage to determine what degree of heat this drug will admit of, without suffering a decomposition. It should, however, be remarked,

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that

(*a*) Diseases of the Army, Edit. 4. p. 213,

(*b*) Vide Experiments XVI. XXIII.

that this infusion though stronger, had neither so agreeable a flavour, nor was so sensibly impregnated with the aroma of the bark, as the two made with cold water.

IN an essay on the DISSOLVENT POWER OF QUICK LIME, a very ingenious chemist hath observed, that all resinous bodies become soluble in water, when the cohesion of their particles is destroyed by withdrawing the fixed air which they contain. This method of solution he endeavours to apply to many valuable purposes in medicine; and hath described several useful and curious processes, for obtaining strong and elegant tinctures of the most active drugs by means of quicklime. The first part of the 10th experiment, *mutatis mutandis*, was borrowed from him; and it was hoped that an efficacious and palatable infusion, might with tolerable expedition be made, by the process which he has laid down. But the success of my experiment was not answerable to the
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the plausibility and ingenuity of the theory, which induced me to attempt it. The infusion after standing twelve hours, the time prescribed by Mr. Macbride, was but weakly impregnated with the bark: And when the maceration had been continued forty eight hours, it by no means equalled in strength the preparation described [Exper. IV.] It appears therefore that quick lime, whatever its effect may be upon other medicines, neither quickens nor increases the solubility of bark in water: And it communicates to the infusion a taste which is intolerably nauseous and disagreeable. That the chalybeate solution should produce no change in the colour of these preparations, is agreeable to the laws of elective attraction. For the acid of the vitriol, having a stronger affinity with absorbent earths than with metallic substances, forsakes the iron with which it was combined, and unites itself to the quick lime. Hence arose the yellow, ochery sediment

taken notice of in the experiment. As the *residuum* after filtration did not effervesce with oil of vitriol, it is evident that quick lime is not endued with the power of abstracting from bark, the fixed air which it contains.

EXPERIMENT XI. furnishes no other inference than this obvious one, that the decoction and infusion of the bark are calculated only for immediate use. The cortex is a substance of a very fermentable nature, as appears from the experiments of Mr. Macbride; and when its active parts are diffused in water, and separated from those which are merely ligneous and inert, it is not to be wondered at that it undergoes those changes, to which all vegetables, when favourably circumstanced, are liable.

SECTION

SECTION II.

IT appears from the preceding section, that the PERUVIAN BARK yields its virtues as perfectly to cold as to boiling water; and that the simple maceration in point of elegance and efficacy, is in many respects preferable to the decoction. But the latter preparation hath this advantage, that it is made with great expedition: For it is a fundamental principle in chemistry, that heat quickens the action of almost every *menstruum*. To avail myself therefore of this assistance without decomposing the bark, I made the following experiment, in the issue of which it will appear that I was disappointed.

EXPERIMENT

EXPERIMENT XII.

A GLASS phial lightly stopped, containing two drachms of powdered bark, well incorporated with three ounces of spring water, was placed in a half pint cup of cold water. The cup was set in a pan of boiling water, and kept in the boiling heat for the space of an hour and half. The phial was then taken out of the vessel, and the heat of it measured by Sir Isaac Newton's thermometer, when it was found to be about eight degrees below the boiling point, which is nearly equal to forty degrees in Farenheit's scale. The infusion whilst hot was clear and of a deep red, but when cold, it assumed a brown colour and had a turbid appearance.

SEVERAL other experiments were tried, in order to determine what degree of heat the bark will bear without decomposition; but I was unable to hit upon the precise point

point. And when I considered that if it could be ascertained, few apothecaries in extemporaneous prescriptions would pay an exact attention to it, I dropt all further attempts towards the discovery of it.

EXPERIMENT XIII.

IT is evident from the 7th experiment, that a considerable quantity of the resin of the bark is soluble in cold water; but I was desirous of trying whether the whole of it might not be dissolved by repeated affusions of the same *menstruum*. For this purpose I macerated half an ounce of powdered bark, for the space of three days, in six ounces of spring water. The *menstruum* was then decanted off, and fresh water added in the same quantity as before. This affusion was repeated at equal intervals thirty times, till the water was insipid, colourless, and unalterable by the addition of green vitriol. The *residuum* also, when chewed in the mouth, had

had no sensible bitternefs or astringency. Two drachms of this *residuum*, carefully dried by a very gentle heat, were infused in an ounce of rectified spirit of wine; and in two days a tincture was produced of an orange colour and bitter taste.

EXPERIMENT XIV.

HALF an ounce of powdered bark loosely tied up in a linen rag, was boiled over a quick fire twenty five times, in so many different pints of spring water. Each coction was continued twenty minutes, and repeated till the *menstruum* received no sensible impregnation from the bark. After the twenty fifth boiling, it was perfectly tasteless, struck no black with *sal martis*, and the powder when chewed in the mouth was equally insipid with the liquor. Two drachms of the *residuum*, cautiously dried, were macerated forty eight hours in an ounce of *sp. vin. rectificat.* The spirits acquired a deeper colour,

lour, and were more strongly impregnated with the bitterness of the cortex, than in the preceding experiment. But neither this nor the former tincture struck a black with green vitriol, owing perhaps to the insolubility of that metallic salt in rectified spirit of wine.

EXPERIMENT XV.

A DRACHM of powdered bark was digested without heat forty eight hours, in two ounces of rectified spirit of wine. The clear tincture was then poured off, and fresh spirit, in the same quantity as before, was added to the *residuum*. The digestion was thus repeated six times, until the *menstruum* acquired neither taste nor colour from the bark. The powder was then carefully dried and afterwards successively macerated, without heat, in two several portions of spring water; to each of which it communicated the property of striking a purple colour
with

with green vitriol. Both these infusions were insipid; so that rectified spirit seems to have the power of extracting all the bitterness of the cortex, though not all its astringency. Is not this fact repugnant to what Dr. Lewis hath observed of this drug, "that its astringency resides wholly in its resin, which does not appear to be in any degree soluble in watery liquors?" (a) The same ingenious writer is likewise mistaken, when he asserts that the resin of the bark melts out in the first boilings, and that the subsequent decoctions are transparent and bitter, without the least turbidness or astringency. (b) For in making the 14th experiment, I found the decoction after the twentieth boiling, struck a purple colour with *sal martis*. The three last trials furnish a striking proof of the slow and difficult solubility of the bark. Fuller says with some

(a) Neumann's Chem. by Lewis, p. 339. Note (x.)

(b.) Ibid.

some degree of admiration, *Cum olim experimenti causa ejusdem (corticis) pulverem sæpius decoxissem, non eo usque vires ejus exhaurire valui, quin vel octavum decoctum adhuc amaricaret (a)*. If his patience had permitted him to extend his experiment, what would have been his surprise to find, that even twenty five coctions, and thirty cold macerations, are insufficient to exhaust the virtues of the *cinchona*?

EXPERIMENT XVI.

IN order to determine with more accuracy the relation which different *menstrua* bear to the bark, I digested a drachm of the cortex, weighed with great exactness in equal quantities, viz. three ounces of each of the following liquors. 1. spirit of wine rectified. 2. French brandy. 3. Rhenish wine. 4. cold water. 5. cold water with the addition of a drachm and half

(a) Fuller. Pharm. Extemp. p. 5.

half of white wine vinegar. After seven days infusion the clear part of each *menstruum* was carefully poured off, and the *residuum* evaporated to dryness. The weight which the bark lost by digestion is expressed in the following table, which shews the comparative powers of solution of the several liquors mentioned above.

Cort. Peruv. 3j. infused seven days in

		Grains.
<i>Sp. vin. rectificat</i>	lost	6
<i>Sp. vin. gallic.</i>	—	$8\frac{1}{4}$
Rhenish wine	—	9
Water	—	8
Water and vinegar	—	8

RHENISH wine, from this experiment, appears to be the most active *menstruum* for the bark. Whether it owes any part of its superiour solvent power to the acid with which it is replete, cannot with certainty be determined; but I am inclined to think it doth not, because the solution
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of the *cortex* is not in the least promoted by the addition of vinegar to water. Dr. Lewis says, that proof spirit extracts less from bark than rectified spirit (*a*); but from the preceding trial, which was made with all possible exactness, it is evident he is mistaken. This experiment likewise affords the most satisfactory proof, that cold water is a powerful *menstruum* for the *cinchona*. It is considerably more active than rectified spirit of wine, and is very little inferior to brandy.

EXPERIMENT XVII.

Two drachms of gentian root were macerated forty eight hours, in three ounces of cold spring water: the same quantity was boiled over a quick fire in four ounces of water, till a fourth part was consumed. The infusion had a more

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(*a*) Mat. Medica. p. 432.

intensely bitter, and at the same time a much less disagreeable taste than the decoction, which was mucilaginous and highly nauseous. Six grains of *sal martis* were added to each; but neither of them changed colour. The same experiment was repeated with Aleppo galls. The decoction manifested more roughness and astringency to the taste than the infusion, but did not strike so black a colour with green vitriol. Dr. Lewis informs us, that by steeping the *carduus benedictus* for a few hours in cold water, a very agreeable bitter is procured; but if heat be employed, the more ungrateful parts of the plant are taken up, and the infusion becomes so nauseous as to provoke vomiting. Camomile flowers, as I have long experienced, yield their bitter very perfectly to cold maceration; and in this way they are much more grateful, than when infused in boiling water. An ounce of flowers and half an ounce of orange peel, macerated in three pints of water for twenty
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four hours, make a light, cheap and agreeable stomachic medicine. Green and bohea tea have a finer flavour in cold than hot infusion, and they strike as deep a black by the former, as by the latter method of preparation. Oak bark, it is well known, is always steeped in cold water for the purpose of tanning: and I suppose the artists in that branch of trade, find that the application of heat is not necessary to extract its astringency. May we not therefore justly conclude from the preceding experiments and observations, that cold water is a more universal and powerful *menstruum*, than hath hitherto been apprehended; and that its use in pharmacy is at present too much overlooked and neglected.

THE result of the 8th experiment was so contrary to my expectations, that I determined to make further trials of the effects of acids, in destroying that property in certain vegetable substances, by which

they strike a black colour with chalybeates, which hath been long regarded as an indubitable test of astringency.

EXPERIMENT XVIII.

AN ounce of the infusion of camomile flowers was divided into two equal portions; to one was added a drachm of white wine vinegar, to the other an equal quantity of spring water. Thus with respect to dilution they were precisely in the same circumstances. A tea spoonful of the solution of *sal martis* was then mixed with each of them. The portion which contained the vinegar, suffered no change of colour; the other instantly assumed a dusky hue. The same experiment was repeated with a very strong triturated infusion of the bark, and the result was nearly the same. As soon as a drachm of the vinegar was added to half an ounce of the infusion, it changed the colour of it from a deep and reddish brown to

to a bright yellow; whilst the same quantity of water, had no sensible diluting effect on the other portion with which it was mixed. The chalybeate solution, as in the former experiment, was then added. It produced no alteration in the portion with vinegar, but the other it changed into a perfect ink.

EXPERIMENT XIX.

To half an ounce of a strong infusion of galls were added two drachms of the solution of *sal martis*. It presently assumed the appearance of ink. Forty drops of the acid of vitriol restored it to its original colour. Thirty drops of the *sp. c. c. vol.* renewed the inky blackness.

In these experiments it is obvious that an affinity subsists between acids, astringents, and bitters; and this suggested to me that they may possibly neutralise each other, and when combined together in

due proportion, form what the chemists term a *tertium quid*. This important point, from which many useful inferences may be deduced, I attempted to ascertain in the following manner.

EXPERIMENT XX.

To half an ounce of a light infusion of the bark I added twenty drops of white wine vinegar. The acid and the bitter entirely corrected each other, and a new taste was induced: after standing twelve hours, the mixture changed from a light yellow to a deep chocolate, and deposited a large brown sediment.

EXPERIMENT XXI.

THE same quantity of vinegar was added to half an ounce of an infusion of Aleppo galls. The mixture was more austere and astringent to the taste than the infusion. After standing twelve hours,
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it deposited a flocculent whitish sediment, and the liquor above became less austere to the taste than the simple infusion itself.

EXPERIMENT XXII.

To equal quantities of spring water and of a strong infusion of gentian root, in separate glasses, was added one drachm of white wine vinegar. The acid was entirely covered by the infusion, but the spring water was manifestly sour to the taste. Sixty drops of the syrup of violets were then added to each. The infusion suffered no change of colour; but the water assumed a light red inclining somewhat to purple. Imagining that the deep colour of the infusion prevented me from perceiving the action of the acid on the vegetable blue, I took the same quantity of old Mountain Wine, which was precisely of the colour of the infusion of gentian, and adding to it a drachm of vinegar and sixty drops of syrup of violets, I found a

slight purple redness manifest itself about an hour after the mixture. The same experiment was repeated with a strong infusion of galls and distilled vinegar; but the result was not so obvious as in the former one, probably on account of the weaker powers of the acid employed.

EXPERIMENT XXIII.

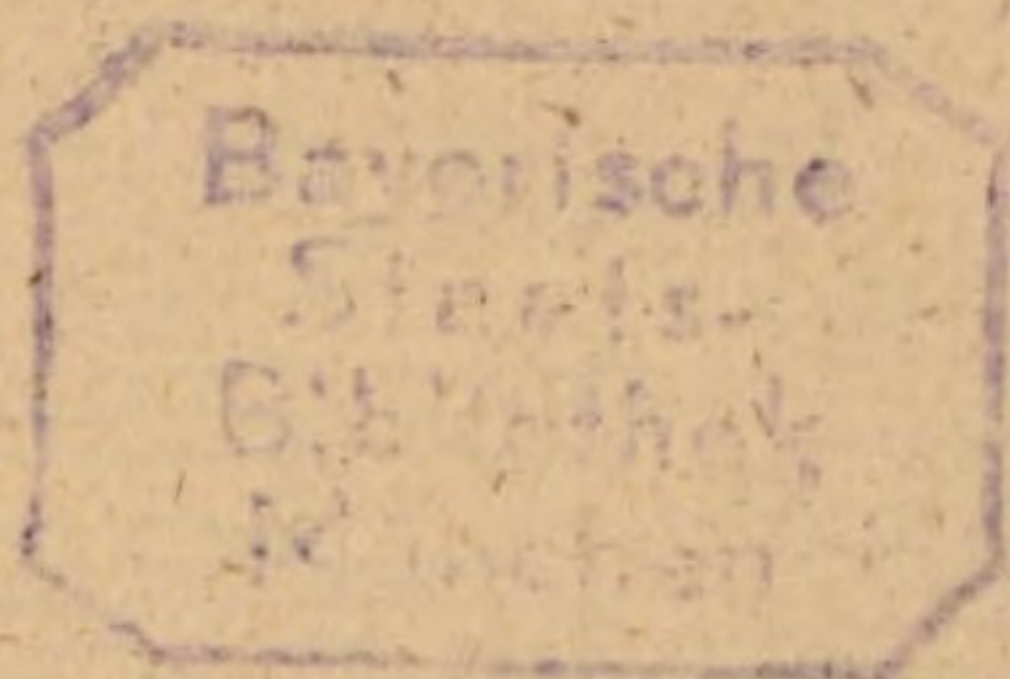
SIR JOHN PRINGLE hath proved that neutral salts resist putrefaction with considerably less force, than the acids and alkalis of which they are composed. *Spiritus mindereri*, for instance, is not half so antiseptic as the *sal. c. c. vol.*: and the common saline mixture of *sal absinth.* and *succ. limon.* is only three fourths as antiputrescent as salt of wormwood separately taken (*a*). Mr. Macbride also hath demonstrated, that acids and alkalis have the power of restoring sweetness to putrid substances,

(*a*) Diseases of the Army, Append. Exp. 5th. 9th.

substances, but that when mixed together to the point of saturation they lose this property (*a*). As there seems therefore, by the three foregoing experiments, to be an analogy between the combination of acids, astringents, or bitters, and acids and alkalis, curiosity induced me to pursue it; and I flattered myself, that though my attempts should prove unsuccessful, some useful facts might offer themselves to my notice, and that my labour would not be without its reward.

AN ounce and half of mutton, chopped very small, was divided into five equal parts, and put into so many different phials. To the first, which was designed for a standard, were added twelve drachms of spring water; to the second, ten drachms of water, and two drachms of white wine vinegar; to the third, ten drachms of the decoction of the bark, and two

(*a*) Macbride's Essays, p. 129.



two drachms of vinegar; to the fourth, ten drachms of the decoction of the bark; to the fifth, ten drachms of water and one scruple of bark finely powdered. The bottles were lightly stopped, and set in a sand bath, the heat of which was regulated by a thermometer, and kept up to the hundredth degree of Fahrenheit's scale. In the night the lamp was suffered to go out. The changes as they occurred in the mixtures were carefully noted down, and were as follows.

THE standard phial in seven hours emitted many air bubbles, and was frothy at top; but had acquired no feter; No. 4. the decoction of the bark, was also a little frothy. The next day the standard smelled offensively, and No. 4. was just perceptibly tainted. The third day, the standard was very fetid; No. 4 was evidently putrid. The fourth day, the standard was so extremely offensive that I removed it. No. 2, the vinegar and water, was

was not quite sweet. No. 3. the decoction of the bark and vinegar, was unchanged. No. 4. the decoction of the bark, was very fetid. No. 5. the powder of bark and water, was quite sweet but a little mouldy. The 5th day, No. 2. the vinegar and water, was more offensive than before. No. 4. the decoction of bark, was so putrid that I removed it. No. 3. and 5. were quite sweet.

THE sixth day. The phials were removed from the sand bath yesterday, on account of an accident which happened to the lamp; and they remained in the cold for twenty hours. This morning they were set by a warm fire. They were not much changed since the last examination.

THE seventh day. No. 2. the vinegar and water, was very offensive, but had a peculiar feter, totally different from the putrid smell of No. 1. and No. 4. It was therefore removed. No. 3. and No. 5. were sweet.

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THE eighth day, No. 3. the decoction of bark and vinegar, was a little tainted. No. 5. the powder of bark and water, was perfectly sweet, and did not become sensibly putrid till the thirteenth day from the time of mixture.

EXPERIMENT XXIV.

To an ounce of putrid ox gall were added an ounce and half of the decoction of bark, one drachm of the powder of bark, and three drachms of white wine vinegar. The putrid smell of the gall was entirely corrected; and the mixture continued sweet fourteen days, though it was placed near a warm fire.

IN the event of the two last experiments I was very much deceived. Before I undertook them I was almost fully persuaded, that there subsisted a compleat analogy between the combination of acids, astringents or bitters, and acids and alkalis; and that the neutrals formed
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by the mixture of the former, like those of the latter, would prove less antiseptic than the substances separately taken of which they are composed. This preconceived hypothesis led me to suspect the present practice of joining acids and the bark, in the cure of putrid diseases, to be very improper, as I imagined they would counteract each others effect. To ascertain this important point, I made the two preceding experiments with the most minute exactness; and though the result of them was the very reverse of what I had supposed, I was neither mortified with my disappointment at that time, nor am I now ashamed to acknowledge it. In a long course of experiments, which are undertaken with some particular view and not made at random, instances of self deception frequently and unavoidably occur. And in general they happily serve as a spur to industry. We first conceive a fact, and then set about the demonstration of it. If the trial succeed, our end is obtained, and

and for the most part we rest satisfied. But if the proof fail, some unexpected phenomena oftentimes occur, which awaken our attention, and excite us to new pursuits. But whether this be the case or not, success or disappointment are equally useful in experimental enquiries; because a negative truth may be of as much importance as a positive one.

THE five last experiments furnish, at least a presumptive proof, that acids and astringents or bitters, neutralise each other. By mixture it appears their taste and smell are altered; the acids lose their property of striking a red colour with syrup of violets; and their antiseptic powers in combination, are double the sum of them when separately employed. The bark likewise with vinegar [Exper. 24.] hath the power of restoring sweetness to putrid substances, which it hath not alone, as Mr. Macbride affirms (*a*). Dr. Pringle hath

(*a*) Macbride's Experimental Essays, p. 130.

hath indeed asserted the contrary; but in his experiment the putrid alkali seems to have been washed off, not corrected, by repeated affusions of the decoction of the bark.

EXPERIMENT XXV.

Four pieces of calf skin, fresh stripped from the calf, and exactly of equal sizes, were immersed, one in an ounce and half of the infusion of bark; the second in an ounce and half of the same infusion with two drachms of white wine vinegar; the third in an ounce and half of the infusion of Aleppo galls; the fourth in an ounce and half of the infusion of galls with two drachms of vinegar. At the end of seven days they were taken out, and carefully examined. The pieces which had been immersed in the infusions of galls and bark with vinegar, were much softer and more swollen, especially in the middle, than the other two pieces: And the

the cuticle very easily separated from the cutis, which was not the case with the others. So that the acid seemed greatly to diminish the astringent powers of these two infusions. The pieces were all so shriveled, that I could not easily measure them, nor determine which was the most contracted in size.

VINEGAR, it is well known, hath the property of softening animal fibres in a very remarkable degree; and diluted with warm water, it is frequently employed as a resolvent in external, topical inflammations. But when taken internally, or applied to any very sensible membrane, it acts as an astringent. Thus in the mouth it corrugates the tongue and palate, and induces a paleness in the lips, by contracting the small capillary arteries which run upon their surface. And when injected into the *vagina*, it proves an excellent remedy in the *fluor albus*, but requires to be let down with water, otherwise it would
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be too suddenly astringent and corroborant. On what principles it is that it produces such opposite effects on the dead and on the living fibre, it would be difficult with certainty to determine. Perhaps its astringent property may depend upon its stimulus, which can only exert itself on the *solida viva*; as the simple solids are the proper subjects of its resolvent power. But although the preceding experiments clearly prove, that vinegar in combination with astringents diminishes their corrugating effects on the dead fibre; I would by no means infer, that its action is the same when applied to the living fibre, or that acids and the bark are improperly exhibited together in the cure of hæmorrhages. From the 21st experiment it appears, that the infusion of galls is rendered much more austere to the taste by the addition of vinegar; and it is not improbable, that its astringent power as a medicine is increased in the same proportion. For I apprehend that

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the taste, with respect to the operation of this class of vegetables on the body, is the least fallacious test of astringency. I term it the least fallacious test, because it will be shewn afterwards, in the succeeding section, that neither the taste, nor the property of striking a black colour with chalybeates, nor yet the power of hardening animal fibres, whether separately or collectively taken, are certain criteria of the astringent power of a medicine on the living body. (*a*)

I SHALL conclude this section with a few obvious, practical inferences, from the foregoing observations and experiments.

I. IT

(*a*) When the 25th experiment was made, it did not occur to me to try the effects of the mineral acids, in conjunction with the vegetable astringents. But I have since found by an experiment, made with the decoction of the bark and elixir of vitriol, that the astringent power of the former is much increased by the addition of the latter.

1. It is the opinion of a very eminent physician, that the bark, when taken in substance disagrees with weak stomachs, on account of its fermenting quality (*a*). But I think the 13th. 14th. and 15th. experiments, which prove its remarkably slow solubility, furnish a better explanation of the fact. When the stomach is overloaded with a dose of the cortex in powder, a sense of weight and oppression, not of flatulency or distension, is for the most part complained of. And it is a common, and I believe useful practice, to join aromatics with the bark, and that doubtless with a view to stimulate the digestive powers, and quicken its passage through the *primæ viæ*. For as it is evident from the experiments of Sir John Pringle himself, that they are of a very fermentable nature, they cannot correct, but must rather promote that tendency in the cortex, and add to the uneasiness which it occasions by the fresh

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(*a*) Pringle's Dis. Army, Append. p. 66.

generation of air. But the best proof that the bark is not so prone to run into fermentation, and that it is in some stomachs almost indigestible, is the case of a patient of the late Dr. Alston, who vomited up a dose of it almost unchanged eight days after taking it (*a*). A very ingenious friend of mine hath remarked in the course of his practice, that the bark in substance is less oppressive when given in draughts, than either in the form of a bolus or electuary. A considerable quantity of unfixed air, he says, adheres to the particles of the powder, which occasions disturbances when carried into the stomach. By combining the cortex with any liquid, this air is in a great measure, he thinks, separated, as appears by the bubbles which are formed, and the frothiness which is produced during the act of mixture.

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(*a*) Cullen's Lect. on the Mat. Medica.

THE fact is curious and I doubt not perfectly true; but the explanation of it is more plausible than satisfactory. The bark when administered in draughts, is generally mixed with some agreeable aromatic water, which renders it more palatable, dilutes it in the stomach, and by its grateful warmth promotes the more speedy digestion of it. But when given in a bolus or electuary, which are for the most part made up with syrups, it is peculiarly nauseous, owing probably to the unpleasant combination of sweet and bitter. And it is a common observation, that what is disgusting to the palate, is generally offensive to the stomach. The more solid form of these two preparations is likewise unfavourable to quick solution. Soap pills have been known to pass through the whole intestinal canal undissolved. In a weak state therefore of the stomach and bowels, we need not wonder that a large mass of an electuary

of the bark, should lie long unchanged and prove very oppressive.

2. As it appears from several experiments, that bitters have the property of neutralising acids, their use in acidities of the first passages is very obvious. In such cases indeed they may be considered as indicated on a double account, to correct the disease when present, and by their bracing and corroborant effects to remove the cause, and prevent the return of it. When given with such intentions, they should be infused in brandy or in some of the stronger wines. It has been long the practice to exhibit bitters in icterical complaints, as a substitute for the bile. But though with this view, they are improperly employed, as being antiseptic, retarders and moderators of fermentation, and consequently very different from the bile, which is possessed of all the opposite qualities; yet I cannot join with a very celebrated physician in opinion,

nion, that they do little or no service in the jaundice (*a*). This disease, when it has been of some standing, is almost always accompanied with loss of appetite and indigestion, and with acidities and flatulencies in the *primæ viæ*. The stomach and bowels, from the defect of bile, are deprived of their usual stimulus, their peristaltic motion is impaired, and the food, by long stagnation, runs with violence through its successive stages of fermentation. In this state of the distemper, the *saliva* and *succus pancreaticus* probably acquire a morbid disposition, and instead of assisting digestion and checking the generation of air, serve rather to injure the one, and promote the other, increasing the general tendency to sourness and crudity. Under these circumstances evacuants, antacids, and antifermentatives are certainly indicated. Vomits and purgatives answer the first, and

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(*a*) Pringle's Append. to Dis. Army. p. 72.

bitters the two last intentions. The former are adapted to remove the cause of the disease; the latter only to palliate some of its most troublesome symptoms. In this view however they are of importance; and the use of them should by no means be discouraged.

3. In a posthumous work of the learned Dr. Boerhaave, published by his pupil Van Eems, it is asserted, that the deleterious effects of scammony, colocynth, and spurge are corrected by vinegar (*a*). These are all vegetable bitters, and probably the action of the acid consists in neutralising them. If this be the case, the use of vinegar as an antidote, may perhaps be more extensive than is commonly supposed. For many of those substances, which on account of their virulent and pernicious effects on the body, are termed poisons, have a considerable degree

(*a*) Boerhaave de Morb. Nervor. Cap. de Paralyfi.

degree of bitterness; as may be instanced in the *lauro cerasus*, *nux vomica*, *helteborus*, *nicotiana*, *camphor*, *opium*, *euphorbium*, *asarum*, *bryonia*, *elaterium*, *chelidonium majus*, &c. And it is at least as probable, that their noxious qualities reside in their bitter, as in any other part of their composition (*a*).

DR.

(*a*) On communicating this conjecture to my ingenious and learned friend Dr. Mathew Dobson of Liverpool, he furnished me with the two following experiments in confirmation of it,

EXPERIMENT I.

“ May 21, 1764. Twelve grains of Opium, dissolved in half an ounce of water, were given to a Pointer Bitch, which weighed twenty five pounds and two ounces. The natural state of her pulse was from 110 to 115 pulsations in a minute; and it should be premised, that in making the following experiments, I never examined the pulse, but after she had been in my room 15 or 20 minutes, and was either asleep or lay at rest.

Soon after giving her the opium, she looked heavy; flavered a great deal; and appeared to be much offended with the taste of the opium.

When at liberty, she went out into the open air, but was dull and moved slowly.

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4. DR. HILLARY, in his treatise on the
Yellow Fever of the West India islands,
discom-

ONE HOUR AFTER; Pulse 75. Very uneasy and distressed. An universal rigor and trembling every five or six seconds.

TWO HOURS AFTER; Pulse 60. Had run out into the street for half an hour; head rather giddy, with an unsteadiness in her gait; complains and groans frequently; heavy, but does not sleep much; flavers a great deal.

THREE HOURS AFTER; Pulse 59. In other respects much the same.

FIVE HOURS AFTER; Pulse 60. Had been in the open air for more than an hour; rather staggered as she went down some steps; frequently kept her head very erect, but not steady; slept very little; lost all her playfulness; flavers; refuses to eat bread; offended with the taste of the opium; and has still the tremblings and twitchings.

EIGHT HOURS AFTER; Pulse 80. More brisk, and seems to be coming to herself again.

TWELVE HOURS AFTER; Pulse 86. Had followed the servant for more than a mile; still more herself.

SIXTEEN HOURS AFTER; Pulse 113. Not much different from her usual appearance.

EXPERIMENT II.

May 28th, 1764. Twelve grains of opium dissolved as in the former experiment, and with the addition of 30 drops of the acid elixir of vitriol, were given to the same Pointer. Much offended with the taste; foams and flavers.

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discommends the use of the bark in that disease, chiefly on account of its disagreeement

ONE HOUR AFTER; Pulse 90. Slavers very little; alert as usual. As she lay asleep in my room, she had a little rigor and trembling.

TWO HOURS AFTER; Pulse 85. There were now given her 20 drops of the elixir of vitriol in an ounce of water; flavered a little after this.

THREE HOURS AFTER; Pulse 80. The flaving soon ceased; is not near so much offended with the taste of the opium as in the former experiment. Rigor and trembling very observable, but only when asleep: 30 drops of elixir of vitriol were now given; and one hour after this, 20 drops more; so that she has had in all 100 drops of the elixir of vitriol, within the four hours.

FIVE HOURS AFTER; Pulse 95. Brisk; some of the twitchings, but only when asleep.

EIGHT HOURS AFTER; Pulse 120. Not much different from her usual appearance; some very slight twitchings as she lay asleep.

These and some other experiments were made, in order to ascertain the efficacy of acids in counteracting the deleterious qualities of opium. When an over dose of opium has remained in the stomach for some time, the sensibility of that organ is almost entirely destroyed, so that the most active emetics are ineffectual to evacuate the poison. It is a matter of consequence therefore in this case, to know what class of medicines we may next have recourse to, with the greatest probability of success. As the opium cannot

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greement with the stomachs of his patients. He acknowledges however, that it is strongly indicated, and seems to lament, that even under the pleasantest form it cannot be retained. But from the 24th experiment I should conclude, that it would sit tolerably easy, or at least that it would not be rejected, if it were combined with the vegetable acids. A redundancy and corruption of the bile are the pathognomonic symptoms of this fever; and notwithstanding the incredible evacuation of it in the first stage of the distemper, there still continues through the whole course of it, both an inordinate secretion of that humour in the liver, and a depravation of it in the first passages. In such circumstances, the bark given by itself cannot fail to disagree; for when mixed with putrid gall, it is observed
be rejected from the stomach, relief is only to be expected from such remedies as will change the nature of the opium itself: and how far this end is to be attained by the liberal use of acids, the reader may judge by comparing these two experiments."

ved greatly to increase the fetor of it (*a*). But when joined with acids, which have the power of neutralising the corrupted bile, as will hereafter be proved, it can occasion no disturbance, and must be highly serviceable, not only as an antiseptic, but also as a corroborant. The truth of this remark is confirmed, even by the practice of Dr. Hillary himself, who exhibits an infusion of snake root as a substitute for the cortex, and accompanies it with the elixir of vitriol.

(*a*) Macbride's Essays, p. 140.

SECTION III.

HAVING frequently observed, during the course of my experiments, that the astringency and bitterness of vegetables are distinct and separate properties, I was desirous of tracing their differences, and of ascertaining the proportion which they reciprocally bear to each other. To this end, I made a variety of trials, and though not with all the success that I wished or expected, yet as they throw some light on this intricate subject, I shall here faithfully relate such of them, as were most conclusive and satisfactory.

EXPERIMENT XXVI.

To equal quantities of strong infusions
of

of Aleppo galls and gentian root, were added two drachms of a solution of green vitriol. The infusion of galls instantly struck a deep, inky blackness: that of the gentian root was unaltered in colour. The former it is well known is very slightly, the latter very intensely bitter.

EXPERIMENT XXVII.

To equal quantities of strong infusions of rue, wormwood, gentian, green tea, bohea tea, bistort, and galls, was added a tea spoonful of the solution of *sal martis*. The galls assumed the deepest black; the infusion of bistort was next in degree; then followed the green and bohea tea, between which I could perceive no difference; the tinge of the wormwood and rue was a little deepened, but the gentian was unaltered. Their degrees of bitterness were in the following order; 1. gentian. 2. wormwood. 3. rue. 4. green and bohea tea. 5. bistort. 6. galls.

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The two last were very slightly bitter. Twenty drops of white wine vinegar discharged the colour, induced by the green vitriol on the infusions of rue and wormwood: a hundred drops considerably diminished the blackness of the infusions of galls, bistort, and bohea tea. But the first, after standing twenty four hours, recovered its inky colour, and a number of fine, jet black flakes floated about in it, without subsiding: The colouring particles of the two last, much diminished in their blackness, sunk to the bottom of the glasses. Twenty drops of oil of vitriol entirely discharged the black colour of the green tea, and it continued clear and pellucid.

EXPERIMENT XXVIII.

To determine the comparative antiseptic powers of bitters and astringents, I put into ten phials marked 1. 2. 3. &c. a drachm and half of mutton, which had been

been kept several days, but was perfectly sweet. To the first, which was intended for a standard, was added an ounce of spring water; to the second, an ounce of a cold infusion of green tea; to the third, an ounce of an infusion of common wormwood; to the fourth, an ounce of the decoction of the bark; to the fifth, an ounce of the infusion of galls; to the sixth, an ounce of a cold infusion of the bark; to the seventh, an ounce of a cold infusion of rue; to the eighth, an ounce of a cold infusion of bistort; to the ninth, an ounce of a cold infusion of bohea tea; to the tenth, an ounce of a cold infusion of gentian. By mistake only the five first phials were placed in the sand bath, the other five were left in my study window, which has a northern aspect. I was called from home, and was absent three days and a half. On my return, I found No. 1. 2. 3. 4. the standard, the green tea, the wormwood, and the decoction of bark, were all putrid, but in different
I degrees,

degrees, according to the order in which they are marked down. No. 5. the infusion of galls was unchanged. The mixtures, which had been left in my study window, were quite sweet; but they seemed to have some little fermentative motion in them. They were placed in the sand bath, and the next day I examined them. No. 7. the infusion of rue was very offensive. No. 6. the infusion of bark was putrid, but in a less degree than the rue. No. 5. 8. 9. 10. were all sweet. The day following No. 9. the infusion of bohea tea was very putrid. No. 8. the infusion of bistort was a little tainted. No. 5. the infusion of galls, and No. 10. the infusion of gentian, continued sweet; and as they remained unchanged several days longer, I removed them from the sand bath, fully satisfied with the proof of their strong antiseptic powers.

EXPER-

EXPERIMENT XXIX.

Eight pieces of calf skin, just stripped from the calf and exactly of equal sizes, viz. two inches long, and an inch broad, were severally immersed in an ounce and half of each of the following preparations. 1. *decoct. cort. peruv.* 2. cold infusion of the bark. 3. cold infusion of galls. 4. cold infusion of gentian. 5. cold infusion of green tea. 6. cold infusion of bohea tea. 7. cold infusion of rue. 8. Simple water as a standard. At the expiration of a week, they were taken out and examined. The piece in the water was soft and putrid. That in the infusion of rue was sweet but soft. Those in the infusions of green and bohea tea, were hard and curled up; nor did there appear to be any sensible difference between them. The infusion of gentian seemed to possess no inconsiderable degree of astringency; for the piece of skin im-

mersed in it, was nearly as hard, and as much shriveled, as those in the infusions of green and bohea tea. The decoction and infusion of the bark were, to all appearance, alike in their degree of astringency, which was rather greater than that of tea, but much inferior to the galls.

THIS experiment affords a striking proof, of the difference between the action of a medicine on the dead, and on the living fibre. Tea, when applied to the former, is manifestly astringent; and yet when received into the stomach, it is highly debilitating and relaxant, and the immoderate use of it is attended with the most pernicious effects. It is curious to observe the revolution which hath taken place, within this century, in the constitutions of the inhabitants of Europe. Inflammatory diseases more rarely occur, and, in general, are much less rapid and violent in their progress, than formerly. Nor do they admit of the same antiphlogistic

gistic method of cure, which was practised with success a hundred years ago. The experienced Sydenham makes forty ounces of blood, the mean quantity to be drawn in the acute Rheumatism; whereas this disease, as it now appears in the London Hospitals, will not bear above half that evacuation. Vernal Intermittents are frequently cured by a vomit and the bark, without venæsection; which is a proof, that, at present, they are accompanied with fewer symptoms of inflammation, than they were wont to be. This advantageous change however is more than counterbalanced, by the introduction of a numerous class of nervous ailments, in a great measure unknown to our ancestors, but which now prevail universally, and are complicated with almost every other distemper. The bodies of men are enfeebled and enervated, and it is not uncommon to observe very high degrees of irritability, under the external appearance of great strength and robustness.

ness. The hypochondria, palsies, cachexies, dropfies, and all those diseases which arise from laxity and debility, are in our days endemic every where; and the hysterics, which used to be peculiar to the women, as the name itself indicates, now attacks both sexes indiscriminately. It is evident, that so great a revolution could not be effected, without the concurrence of many causes; but amongst these, I apprehend, the present general use of tea holds the first and principal rank. The second place may perhaps be allotted to excess in spirituous liquors. This pernicious custom, in many instances at least, owes its rise to the former, which by the lowness and depression of spirits it occasions, renders it almost necessary to have recourse to what is cordial and exhilarating. And hence proceed those odious and disgraceful habits of intemperance, with which too many of the softer sex of every degree, are now, alas! chargeable.

FROM

FROM the 27th. and 29th. experiments it appears, that green and bohea tea are equally bitter, strike precisely the same black tinge with green vitriol, and are alike astringent on the simple fibre. From this exact similarity in so many circumstances, one should be led to suppose, that there would be no sensible diversity in their operation on the living body. But the fact is otherwise. Green tea is much more sedative and relaxant than bohea; and the finer the species of tea, the more debilitating and pernicious are its effects, as I have frequently observed in others and experienced in myself. This seems to be a proof, that the mischiefs ascribed to this oriental vegetable, do not arise from the warm vehicle by which it is conveyed into the stomach, but chiefly from its own peculiar qualities (*a*). And these

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qualities

(*a*) Theæ infusum, nervo musculove ranæ admotum, vires motrices minuit, perdit.

Smith Tentamen Inaug. de actione musculari,

p. 46. exp. 36.

qualities probably accompany the highly flavoured parts of the leaves, and depend upon the nicety and care observed in the collection and preparation of them. When fresh gathered, they are said to be narcotic, and to disorder the senses; and the Chinese cautiously abstain from the use of them, till they have been kept for twelve months (*a*). It is remarkable that only one species of the tea plant is yet discovered, and that all the varieties of this dietetic article of commerce, are owing either to the difference of climate, or to the diversity in the method of curing it. The fine green teas, which are the first crop of the shrub, are gathered with the utmost caution and dried with the gentlest heat, that their perishable flavour may be preserved. The bohea teas are more hastily exsiccated, and even slightly parched over the fire, by which they acquire that brown colour which distin-

(*a*) Neumann's Chemistry, p. 376.

distinguishes them. And as their more volatile parts are dissipated by this management, they become proportionably less injurious to the nervous system.

BUT however cogent the objections may be, against the general and too frequent use of tea, candour obliges me to acknowledge, that it is capable of being applied to very important, medicinal purposes. From its sedative power, and the weakness which it suddenly induces, it might be administered with advantage in ardent and inflammatory fevers, in order to abate the force, and lessen the inordinate action of the *vis vitæ*. In such cases it should be given either in substance or in strong infusion; and besides allaying the troublesome sensations of heat and thirst, which are the constant concomitants of those distempers, it would probably serve as a good substitute for some of the usual evacuations. And thus instead of producing
watch-

watchfulness, which is a common effect ascribed to it in weak habits, it would in all likelihood prove the safest and most salutary opiate. After a full meal, when the stomach is oppressed, the head pained, and the pulse beats high, tea is a grateful diluent, and agreeable sedative. And as studious, sedentary men are particular subject to indigestion and the head ach, it is on this account justly stiled “the poet’s friend.” Other uses to which tea is applicable might easily be pointed out; but I have already made too long a digression.

THE 29th. experiment affords a further proof, that the astringent parts of the cortex are as well extracted by maceration as by decoction. But I am inclined to think from this, and many other trials, that the astringent quality of this medicine is not so great as it is commonly reputed to be: and consequently the prejudice entertained against the use of it, in cases where powerful astringents are supposed

posed to be contraindicated, is without sufficient foundation. Thus it hath been a commonly received rule not to exhibit the bark in intermittents, before the disease be in some measure spontaneously abated; and then to administer it only in the intervals of the fits (*a*). But this extreme caution, as it took its rise at first from false theory, is found by later experience to be in most instances unnecessary; and the cortex is now frequently given with the utmost safety and success, after previous evacuations, not only at the commencement of the disorder, but even just before the accession of the cold fit. This was the common method of exhibiting the bark when it was first introduced into Europe (*b*). But Sydenham informs us, that not long after it came

(*a*) Curandum est ante omnia ne præmature nimis hic cortex ingeratur, ante scilicet quam morbus suo se marte aliquantisper protriverit.

Sydenham. Opera. p. 57.

(*b*) Tho. Bartholin. Hist. Anatom. Medic. Cent. 5. p. 108.

came into disuse, for two reasons;
“ *Primó quia paucis horis ante adventum paroxysmi, pro recepto id temporis more, exhibitus, ægro nonnunquam è medio tolleret. Funestior hic pulveris exitus, quamvis oppidó rarus, medicos tamen paulo cordatiores ab ejus usu meritó retraxit. Secundó quia æger ope pulveris, à paroxysmo aliás in vasuroliberatus, quod plerumque eveniebat, tamen intra dies 14. recidivam ut plurimum pateretur, in morbo scilicet recenti, necdum temporis cursu suoque marte committigato* ” (a). The last objection would have been obviated by a longer use of the bark ; the first is totally without foundation. For the very few instances of mortality (Sydenham only enumerates two) which immediately succeeded the exhibition of the cortex, were not to be ascribed to the operation of the powder, but to the violence of the cold fit, which without doubt would have carried off the patients, had no medicine been

(a) Sydenhami Opera, p. 265.

been administered. For the natural tendency of the bark is to moderate, and not to increase the force of the paroxysms. And so far is it from producing obstructions, when given, with proper precautions, at the beginning of intermittents, that it effectually prevents them, by putting a speedy stop to the disease, the continuance of which in weak habits is the true cause of their formation. “ I am convinced, says Mr. Cleghorn in his excellent treatise on the diseases of Minorca, that the unhappy *metastases*, which some have observed to follow the use of the bark, are exceedingly rare, and ought rather to be ascribed to other causes than to this medicine. And I will venture to affirm, that more bad consequences ensue from giving it too late than too soon; prostration of strength, sudden death, or the most obstinate chronic diseases, being the usual effects of delay. Whereas the worst that commonly happens from the too early use of it, is that
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it does not at once restrain the paroxysms like a charm, without any sensible evacuation, as it frequently does, when given after the fever has arrived naturally to its height, and begins to decline of its own accord" (*a*). In another part of his work, the same ingenious and accurate writer observes, "that the great advantage which accrues from the early use of the bark in tertians is, that it invigorates the powers of the body, prevents or removes the dangerous symptoms, and brings on a crisis soon and with little disturbance. Instead of suppressing any beneficial discharge, as some have asserted, we daily observe a laudable separation in the urine, warm, profuse, universal sweats, plentiful bilious stools, and sometimes the hæmorrhoids, and menses coming on after it has been used; though it effectually restrains the colliquative night sweats, to which persons weakened by tedious inter-
mittents

(*a*) *Dis. of Minorca*. p. 206.

mittents are incident" (*a*). Morton, who had great experience of the innocence and efficacy of the *cinchona*, frequently prescribed it without premising any evacuations; and he asserts, that after twenty-five years practice, he never knew the least bad consequence ensue from its exhibition, nor had ever occasion to repent the use of it. In the inoculated small-pox, instances of severe ague fits have been known to attack persons, between the insertion of the variolous matter and the eruption of the pock, when the bark hath been given liberally and with success, the principal business in the mean time suffering no injury or interruption (*b*). The retrocession of the morbid acrimony in the measles, is prevented by nothing more powerfully than by the cortex, which obviates the secondary fever, allays the cough, and continues the efflorescence on the

(*a*) *Ib.* p. 189. 190.

(*b*) *Vid.* Dimsdale on Inoculation. p. 12. *vid.* also the Monthly Review for Sep. 1766. p. 189.

the skin even to the twelfth day: whilst the disease runs through its accustomed stages with the utmost regularity, and creates much less disturbance and alarm than usual (*a*). I had lately under my care a patient, who was seized with an intermittent whilst he laboured under a severe *gonorrhæa*. The bark was given him in large quantity; and so far was it from suppressing the discharge, that it evidently increased it, and at the same time diminished its virulence. The late Dr. Whytt informs us, that he swallowed in sixteen days, near four ounces of it in substance, when he laboured under a catarrhus cough, without feeling any bad effects from its astringent quality. In a tertian, attended with a cough and spitting, after the use of vomits and some pectorals, he prescribed the cortex in the usual quantity, without the breast being any way hurt by it. And he had repeated experience

(*a*) *Vid* Dr. Cameron's Paper Med. Museum, p. 281.

ence of its virtues in curing a hoarseness after the measles, when unattended with a fever or difficult respiration. In the hooping cough also, when given early, he found it one of the best remedies (*a*). These facts sufficiently evince the common apprehensions concerning the astringent quality of the *cinchona* to be groundless. And it may be hoped, that all such prejudices against the use of it will now vanish; as by its efficacy in the cure of scrophulous, glandular tumours, it is proved to be even a powerful deobstruent.

THE property of striking a black colour with green vitriol hath been ascribed to all vegetable astringents without exception, and hath hitherto been regarded as an infallible test of their astringency (*b*). But from the 26th. 27th.

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and

(*a*) Whytt on Nervous Disorders, p. 241.

(*b*) The power by which they produce this blackness, says a very celebrated chemist, and their astringency, or that

and 29th. experiments it is evident, that neither the one nor the other are strictly and universally true. For gentian appears to be endued with no inconsiderable astringive power, and yet the infusion of it suffers not the least change from the addition of *sal martis*. On the contrary, the infusion of rue has no degree of astringency on the dead fibre, and yet it strikes a faint black with green vitriol.

THE action of acids in neutralising vegetable bitters, as described in the last section, naturally led me to try their effects on the animal bitters. For this purpose I procured a quantity of fresh ox gall; but being prevented for several weeks, by various avocations, from pursuing my experiments, I found the gall
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that by which they contract an animal fibre, and by which they contribute to the tanning of leather, seem to depend upon one and the same principle, and to be proportional to one another.

Lewis Com. Ph. Tech. p. 345.

at the end of that term extremely putrid. This accident pointed out to me a train of enquiries, somewhat different indeed from what I had at first proposed to myself, but which afterwards appeared to be much more interesting and important. I shall therefore make no apology for laying before the reader the result of them.

EXPERIMENT XXX.

PUTRID ox gall, diluted with water, struck a green colour with syrup of violets, and sensibly effervesced with oil of vitriol, became turbid and of a light yellow colour. This experiment was repeated several times, and always with the same success; so that I am pretty confident there must have been some error in that trial of Mr. Macbride's, from which he concludes, "that putrid ox gall shews no sign of alkali; it neither effervesceeth with acids, nor does it change the colour of the blue juices; neither

does it throw down any precipitate from the solution of corrosive sublimate" (*a*). At first it occurred to me, that the mistake into which this very ingenious and accurate experimentalist hath fallen, might arise from his not diluting the gall before he added the acid; by which the latter would be so inviscated, as not to give sufficiently evident signs of effervescence. But afterwards the curious observations of M. Gaber of Turin, concerning putrefaction, suggested to me a still more probable source of fallacy to which Mr. Macbride was exposed. That learned Italian hath clearly proved, "that the marks of alcalescence in putrefying animal substances, are greater or less, or none at all, according to the time the experiment is made after the putrefaction begins; that such substances, upon their first putrefaction, do not effervesce with acids; that afterwards they effervesce manifestly

(*a*) Macbride's Essays, p. 101.

nifestly with them ; but that at length they cease from doing it, though the putrefaction still continues" (*a*). Now it is not unlikely that Mr. Macbride's trial on the ox gall, was made, either before the volatile alkaline salt was formed, or after it was evaporated ; as Dr. Pringle candidly acknowledges happened in his experiments on putrid substances.

EXPERIMENT XXXI.

To two drachms of putrid ox gall, diluted with half an ounce of water, were added twenty drops of *ol. vitriol.* a light yellow cloud instantly formed itself, and the mixture slightly effervesced and became turbid : But though the peculiar fetor of the gall was destroyed, yet it emitted a strong and disagreeable smell, nor was its bitter taste entirely corrected.

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Thirty

(*a*) *Vid.* Miscellanea Phil. Mathem. Societat. Privat. Taurinensis: *vid.* also, Pringle on the Diseases of the Army. Append. p. 125.

Thirty drops rendered the mixture rather sharp to the taste; but still the bitterness was perceptible: Nor did forty drops entirely destroy it, although that quantity made the mixture very sour. After standing a while, it assumed a deep green colour, a sediment gradually formed itself, which in twenty four hours subsided to the bottom of the glass, and left the liquor above almost clear.

EXPERIMENT XXXII.

To the same quantity of putrid gall and water as in the former experiment, were added forty drops of white wine vinegar. The putrid fetor was entirely destroyed, and no other disagreeable smell was produced in its room. The mixture became turbid, but in a less degree than the former with the oil of vitriol; and the effervescence was likewise much more obscure. Sixty drops of vinegar seemed nearly to neutralise the gall. For though some small

small degree of bitterness remained, it was very trifling, and by no means unpalatable.

EXPERIMENT XXXIII.

To a third glass of gall and water, mixed together in the above-mentioned proportions, were added forty drops of juice of lemons. The mixture became turbid, but the putrid smell was scarce perceptibly covered. A hundred and twenty drops neutralised the mixture, entirely correcting both the odour and taste.

I. FROM these experiments may be deduced, the great utility of acids in all diseases which either proceed from, or are accompanied by a redundancy and depravation of the bile. And this seems to be the case with most autumnal fevers, and in general with the epidemics of all hot countries, especially where heat and moisture are conjoined. For the former

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promotes

promotes the generation, and the latter the putrefaction of the bile. I have been assured, says Dr. Bryan Robinson, by a very knowing butcher, that animals have least bile in January and most in July (*a*). And Hippocrates hath observed, *Æstate sanguis adhuc viget, sed et bilis exaltatur; per æstatem etiam ac autumnum bile corpus abundat; autumno autem atra-bilis plurima est et fortissima* (*b*). Mr. Cleghorn, in his account of the diseases of Minorca, informs us, that he examined the bodies of near a hundred persons who died of tertian fevers, and that he constantly found the *vesica fellea*, and the stomach and intestines overflowing with bilious matter (*c*). The testimony of Prosper Alpinus likewise, strongly confirms the truth of this observation. He says, *Alexandriæ autumno grassantur febres pestilentes multæ lethales, quæ fere quamplurimos invadunt.*

(*a*) Robinson on the Operation of Medicines, p. 48.

(*b*) Hippocrates lib. de Nat. Hom. sect. 14.

(*c*) Dis. of Minorca, p. 165.

vadunt. His vero notis pleræque dignoscuntur: in principio enim vomitus multi, biliosi ac virulenti observantur, à quibus cibum assumptum continere nequeunt, assidueque corporis agitationibus, inquietudinibusque vexantur, stomachique angore anguntur. In plerisque etiam observantur multæ, symptomaticæ dejectiones, liquidæ, biliosæ, variæ, admodum ægré olentes sive fetentes (a). The yellow fever of the West Indies is always at the beginning attended with great sickness, violent retching, and a copious discharge of bile. The vomiting recurs at short intervals, often becomes almost incessant, and an incredible quantity of bile is sometimes thrown up in a few hours. (b)

2. THE difference between the action of mineral and vegetable acids on putrid gall, as evidenced in the preceding trials, is

(a) Alpinus de Medicin. Ægypt. lib. 1. cap. 14. p. 51.

(b) Vid. Hillary's Observ. on the Dis. of Barbadoes; vid. also Bisset's Medical Essays and Observations.

is deserving of particular notice. From the ignorance of this distinction, or want of attention to it, I believe the elixir of vitriol is often exhibited, when vinegar, or the four juices of vegetables, would be much more serviceable. For though it is the common property of all acids to *correct* the putrid acrimony; yet the power of *sweetening* it, seems to be peculiar to those of the vegetable class. And as they are mildly aperient at the same time, they will not only neutralise the septic *colluvies*, which in some diseases lodges in the stomach and flexure of the *duodenum*, but will also gently tend to evacuate it: an advantage not to be expected from the mineral acids.

3. MR. BROWNE LANGRISH, in his Modern Theory and Practice of Physic, relates the case of a poor man, who after eating heartily of stale mutton, which he bought on account of its cheapness, was affected with vomiting and purging
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to a strange degree, and in all respects seemed as if he had been poisoned. Vinegar, diluted with water, contributed more than any other medicine towards his cure.

4. A TABLE spoonful of the juice of lemons, unmixed with any thing, is said by an ingenious writer (*a*), to have repeatedly proved a certain cure for a palpitation of the heart, after many of the medicines, called antihysterical, had been tried in vain. This effect he ascribes to an uncommon disposition in the nerves of the stomach. But I think it is not improbable that the complaint proceeded from bilious acrimony, which the vegetable acid corrected and neutralised. This conjecture is confirmed by a similar case which Dr. Bisset hath related, of a middle aged gentleman who had a palpitation of the heart, accompanied with some symptoms

(*a*) Whytt on Nerv. Disorders, p. 372.

symptoms of the jaundice, and who was completely cured by drinking every evening weak rum punch, acidulated with the juice of Seville Oranges (*a*).

5. FROM the effect of acids on the gall, we may infer the reason why the immoderate use of them so much impairs digestion. The bile in its natural state is a saponaceous fluid, absolutely necessary to chylification; and whatever weakens its powers, must proportionably injure the due concoction and assimilation of our food. Hence the body is deprived of its proper nourishment and support, the blood becomes vapid and watery, and a fatal cachexy unavoidably ensues. This has been the melancholy lot of many unfortunate persons, who in order to reduce their excessive corpulency, have indulged themselves in the too liberal use of vinegar.

6. IT

(*a*) Bisset's Medical Essays and Observ. p. 254.

6. It is not improbable that the acidities, to which infants are peculiarly subject, arise as much from the weakness of their biliary secretions, as from the acescency of their food. The liver of a child is extremely lax in its texture, and with respect to his bulk, is much larger than the liver of an adult: Hence the secretions of the one, will be proportionably greater than the secretions of the other. But though the bile flows copiously, yet the powers of nature in the state of infancy are too feeble for its due preparation; and it is a mere watery, inert fluid, unfit for neutralising those acidities, which in the more advanced stages of life, it is one part of its office to correct. And this, I apprehend, is a principal cause of their redundancy in the *primæ viæ* of children.

THE frequent opportunities which the preceding course of experiments afforded me,

me, of observing the effects arising from the combination of green vitriol and astringents, naturally led me to examine into the principles of INK. And as the subject is not only curious in itself, but also interesting and important, from its relation to the arts of dying and staining black, I was induced to institute a new set of trials, in order to the more clear and accurate investigation of it. That a solution of vitriol strikes a deep black with vegetable astringents, is a fact universally known; but Dr. Lewis is almost the only chemist who hath attempted to explain it. He is of opinion that the colouring matter of ink is iron, extricated from its acid in a highly attenuated or divided state, and combined with a peculiar species of matter contained in astringent vegetables. Acids, he says, destroy its blackness by redissolving the ferrugineous particles; and alkalis by uniting with the astringent matter, and precipitating the iron nearly
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in the same ochery state, as they do from the simple acid solutions of the metal (*a*).

BUT from the following experiments I think it will fully appear, that this very ingenious and useful chemist is mistaken; and that the colouring matter of ink is iron, not extricated from, but in combination with an acid.

EXPERIMENT XXXIV.

To half an ounce of the decoction of galls, was added one grain of *sal martis*: An inky blackness succeeded. Sixty drops of *sp. c. c. vol.* discharged the black, and rendered the liquor thick and brown coloured. A hundred and twenty drops of oil of vitriol restored the blackness; two hundred again discharged it, and gave the ink a yellow cast, inclining to green. This experiment is illustrated by the following one.

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(*a*) Lewis Comm. Ph. Tech. p. 348.

EXPERIMENT XXXV.

ONE grain of green vitriol was dissolved in half an ounce of spring water: forty drops of *sp. c. c. vol.* were added; a greenish yellow sediment formed itself, and presently subsided to the bottom of the glass, with little white flakes, which I at first judged to be calcareous earth, separated from the spring water by means of the volatile alkali. But the *sp. c. c. vol.* mixed with the same water, produced no precipitation. Oil of vitriol was then dropped in, to the point of saturation. When the effervescence ceased, the whole sediment was redissolved, and the mixture became quite clear,

EXPERIMENT XXXVI.

A PIECE of polished iron was immersed in a cold infusion of the bark, made with distilled water. In three hours the liquor was

was just perceptibly tinged with black. The piece of iron was then taken out, wiped clean, and again immersed in another infusion of the cortex, of equal strength with the former, made with common spring water. In less than two hours, the infusion assumed a deep purple colour, and the fluid in contact with the iron was of an inky blackness.

THIS experiment clearly proves, that an acid is necessary to the formation of ink. Spring water is generally impregnated with some of the mineral acids, in combination either with certain metallic substances, the fossil alkali, or calcareous earth. The water employed in this trial, contained a considerable portion of selenitic salt; and hence it was capable of dissolving the iron which was immersed in it, and of forming with it a perfect *sal martis*. This sufficiently accounts for the deep purple hue which the infusion assumed. The distilled water was either

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not sufficiently pure, for I did not particularly examine it, or the cortex, which like all other vegetable substances, is of an acedent nature, communicated to it a slight degree of acidity, by which the iron was corroded, and a faint and scarce perceptible blackness produced.

EXPERIMENT XXXVII.

THREE or four drachms of *sal martis* were dissolved in half a pint of boiling water. After standing a few days, that the ochre might precipitate, the solution was passed through brown paper. The filtered liquor was perfectly clear, discovered no marks of acidity to the taste, and struck a deep black with the infusion of galls. In four or five days it let fall a very fine, light, yellow sediment, was again passed through the filter, and struck as before a deep black with the infusion of galls. I did not prosecute this experiment any further; being satisfied from
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the trial I had made, that the acid and the iron, the component parts of green vitriol, are not so easily separated from each other as is commonly supposed. And it is probable that the acid, after the precipitation of the ochre, still retains as much ferrugineous matter as is sufficient to saturate it, when so much diluted with water.

EXPERIMENT XXXVIII.

FROM a large copperas work established near Wigan, I procured a quantity of the yellow ochre precipitated from green vitriol; and of a chocolate coloured pigment, made by exposing the ochre to such a degree of heat, as is sufficient to separate the acid, and give it what the painters term a BODY. Neither the ochre, nor the pigment were attracted by the magnet, a proof that they were both in a state of calcination. Three grains of the ochre, and the same quantity of the

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chocolate

chocolate coloured pigment were added to two glasses, each containing half an ounce of a decoction of the bark. The pigment communicated to the decoction its own peculiar colour; but the yellow ochre struck with it a deep purplish black. Twenty drops of *sp. c. c. vol.* made no change in the decoction with the pigment; but the other instantly lost its black, and assumed a chocolate colour, exactly resembling that of the pigment.

EXPERIMENT XXXIX.

THE result of the last experiment led me to imagine, that an alkali dropped upon the ochre would render it brown by abstracting its acid; and on the contrary, that oil of vitriol added to the chocolate pigment would restore its yellow colour, and give it the property of striking a black with vegetable astringents. I therefore diffused four grains of the ochre, and the same quantity of the pigment, in two glasses

glassies of water. To one I added twenty drops of *sp. c. c. vol.* to the other the same quantity of *ol. vitriol.* The hartshorn immediately precipitated the ochre in fine light flakes, but did not either effervesce with it or alter its colour: The acid had no sensible effect on the pigment. Thus was I doubly disappointed in the issue of this experiment.

EXPERIMENT XL.

A few drachms of the yellow ochre were well mixed with four ounces of spring water. As soon as the ochre subsided, the liquor above was carefully poured off, and passed through common filtering paper doubled. It had acquired a deep orange colour, was perfectly transparent, had an aluminous taste, and was remarkably styptic and astringent in the mouth. A drachm of it struck a deep green, inclining to black, with half an ounce of the bark decoction. I drop-

ped twenty gutts of *sp. c. c. vol.* into a table spoonful of it: No effervescence ensued, but a very copious, flaky, and yellow sediment was instantly produced. I kept the remainder of the orange coloured liquor, in an open glass vessel for several weeks, without observing the least ochery precipitation, or any diminution of its transparency. And this I apprehend is a proof, that a firm and lasting combination takes place, between certain proportions of the component parts of green vitriol.

THE same ochre was macerated in fresh parcels of water, till the filtered liquor had neither taste, colour, nor the property of giving the least black tinge to an infusion of galls. The ochre was then dried by a very gentle heat, and two scruples of it were added to half an ounce of the same decoction of the bark, which was used in the former experiments; but no change of colour ensued, only the decoction

coction assumed a lighter yellow, whilst the particles of the ochre floated in it.

EXPERIMENT XLI.

SPIRIT of hartshorn, dropped into a solution of green vitriol, occasioned a copious precipitation, but no effervescence. It cannot be alledged therefore, that the yellow ochre contains no acid, because it doth not raise a sensible ebullition with the volatile alkali.

THUS it appears that whatever deprives green vitriol of its acid, whether it be heat, the addition of an alkali, or repeated affusions of water, destroys its power of striking a black colour with vegetable astringents. May we not then justly conclude, that an acid is essentially necessary to this property, which it is more than probable depends upon the composition of the copperas as a mixt; and not upon either of its constituent parts separately

taken. Ink therefore is a combination of vitriolic acid, iron, and a certain proportion of vegetable astringent matter. But as these principles bear but a weak relation to each other, their band of union is easily dissolved, and it has long been a desideratum in chemistry, to render it more fixed and permanent. Acids by attracting the astringent matter, with which it is evident from many of the foregoing experiments they have a strong affinity, discharge the black colour of ink. Alkalis on the contrary decompose it, by abstracting the acid from the vitriol, and precipitating the iron. If the blackness hath been destroyed by an acid, the addition of an alkali in due proportion will restore it, and *vice versa*. The reason why they thus counteract each others effects, is too obvious to require an explanation.

A RE-

A RECAPITULATION OF THE PRINCIPAL
FACTS ASCERTAINED BY THE PRE-
CEDING EXPERIMENTS.

1. **T**HE PERUVIAN BARK, and many other vegetable bitters and astringents, yield their virtues as perfectly to cold as to boiling water.

2. As much of the Resin of the Bark is dissolved by cold maceration as by coc-
tion.

3. TRITURATION promotes and in-
creases the solution of the Bark in water.

5. QUICK LIME neither quickens, nor increases the solution of the bark in water, contrary to the assertion of Mr. Mac-
bride.

6. THE

6. THE BARK will not yield all its virtues either to cold water, boiling water, or rectified spirits of wine, nor probably to any other *menstruum* singly employed. After thirty cold macerations, and twenty five coctions in different parcels of water, each *residuum*, though perfectly insipid, yielded a bitter and astringent tincture when digested in rectified spirits of wine. On the contrary after repeated digestions in rectified spirits of wine, when that *menstruum* acquired neither taste nor colour from the bark, cold water extracted from it a manifest degree of astringency.

7. COLD WATER is a more powerful solvent of the bark, than rectified spirit of wine. But brandy is a stronger *menstruum* than water, and Rhenish wine than brandy.

8. ACIDS, BITTERS and ASTRINGENTS neutralise each other, forming
what

what the chemists term a *tertium quid*. When combined together in due proportion, their taste and smell is altered; the acids lose the property of striking a red colour with syrup of violets; and their antiseptic powers in combination are double the sum of them when separately employed. The bark likewise with vinegar hath the property of restoring sweetness to putrid substances, which Mr. Macbride affirms it hath not alone.

9. THE VEGETABLE ACIDS combined with astringents diminish their astringent power on the dead fibre; the mineral acids increase it.

10. ASTRINGENCY and BITTERNESS are distinct properties, and are united together in very different proportions in different vegetables.

11. NEITHER the taste, nor the power of striking a black colour with chalybeates,

beates, nor yet the property of hardening animal fibres, whether singly or collectively taken, are certain criteria of the astringent power of a medicine on the living body.

12. THE power of striking a black colour with green vitriol is not always a test of astringency on the dead fibre; nor is it common to all vegetable astringents. Rue yields a faint black, on the addition of *sal martis* to an infusion of it, and yet is not astringent: Gentian on the contrary, strikes no black, although it is a pretty strong astringent.

13. PUTRID GALL is neutralised by all acids. But those of the native vegetable class alone, entirely sweeten it.

14. WHATEVER deprives green vitriol of its acid, whether it be heat, the addition of an alkali, or repeated affusions of

of water, destroys its power of striking a black colour with vegetable astringents.

15. AN ACID, contrary to the opinion of Dr. Lewis, is essentially necessary to the above-mentioned property of green vitriol.

16. INK, seems to be a combination of vitriolic acid, iron, and a certain proportion of vegetable astringent matter.

of water, thereby in power of thinking
a black color and vegetable nitrogen.

17. The acid, contrary to the opinion
of the latter, is essentially necessary to
the above mentioned property of green

which is the cause of the green color
of the leaves. It is also to be a combination of
nitrogenous matter, and a certain pro-

portion of vegetable nitrogenous matter.

18. The acid is also to be a combination of

nitrogenous matter, and a certain pro-

portion of vegetable nitrogenous matter.

19. The acid is also to be a combination of

nitrogenous matter, and a certain pro-

portion of vegetable nitrogenous matter.

20. The acid is also to be a combination of

nitrogenous matter, and a certain pro-

portion of vegetable nitrogenous matter.

21. The acid is also to be a combination of

nitrogenous matter, and a certain pro-

portion of vegetable nitrogenous matter.

22. The acid is also to be a combination of

nitrogenous matter, and a certain pro-

portion of vegetable nitrogenous matter.

23. The acid is also to be a combination of

nitrogenous matter, and a certain pro-

portion of vegetable nitrogenous matter.

ESSAY IV.

ON

THE USES

AND

OPERATION

OF

BLISTERS.

*Certé hinc lucis aliquid erui poterit, quâ
id tandem, in quo medicorum diligentiam
desidero, effici queat, ut accurata de ve-
sicantium in diuturnis affectibus præcepta
tradantur, quæ et perspicuitatem habeant,
et quasdam errare in medendo non patien-
tes vias,*

FRIEND.

ESSAY IV.

ON THE USES AND OPERATION OF BLISTERS.

THOUGH the action of cantharides as vesicatories was not unknown to the ancients, their application did not prevail much in practice, till the beginning of the last century. And as nothing hath tended more to enlarge the boundaries of science, than the contentions of the learned; we owe perhaps, in a good measure, our present more accurate acquaintance with the virtues and operation of blisters, to a dispute amongst the Italian physicians, relating to their use in a plague, which prevailed about the years 1575 and 1590. But although blisters
M are

are now almost universally employed, and experience hath ascertained their utility in various disorders; the theory of their action, as well as the mode of their operation, is yet undetermined, and remains a subject of litigation. Hence arises that diversity of opinions concerning the diseases in which they are indicated, the time of their application, and the parts to which they ought to be applied. Nor can we ever hope for uniformity in this particular amongst physicians, either with respect to their opinions or their practice, till a juster idea be formed of their mode of action, deduced from experience, and an attentive observation of their effects on the human body. When this is accomplished, a system of rules may be laid down for their right and advantageous application.

MEDICINES are generally divided into such as act 1. on the solids; 2. on the fluids: and blisters may be considered as belonging

belonging to each of these classes; though their relation is chiefly to the former. But here a question occurs, whether vesicatories produce their effects by their external action on the body, or by the absorption of their stimulating particles into the system? Baglivi furnishes us with two curious, though cruel experiments, of the injection of two ounces of the tincture of cantharides, into the jugular veins of a dog and a whelp. Great anxiety, violent pain, insatiable thirst, convulsions, and death, were the consequences in each instance. But no certain or just inferences can be drawn from these experiments; because medicines are not administered by injection into the blood vessels; and substances much less acrid in their nature than cantharides, if conveyed directly and undiluted into the course of circulation, will be found to produce effects similar, or at least equally deleterious (*a*). When

M 2

taken

(*a*) New milk injected into the veins of a dog proves a mortal poison.

Young on Opium, p. 6.

taken by the mouth in an over-dose, the most dreadful symptoms succeed; an ulceration of the bladder and *urethra*, inflammation of the bowels, violent pains in the *hypogastrium*, extreme thirst, a high fever attended with delirium, and at last death closes the melancholy scene. The like effects it is said, though in a less degree, have been observed to arise from the application of blisters. And it is upon these active powers of cantharides when absorbed into the system, properly modified and seasonably applied, that the effects of vesicatories are supposed by several learned writers chiefly to depend (*a*). The quicker contractions of the heart and arteries, in consequence of their application in certain disorders, they ascribe, not to a sympathy with the skin, but to a stimulus circulated with the fluids, and acting immediately on the vessels themselves. And as Baglivi hath asserted

(*a*) Baglivi, Friend, Glafs, Huxham, &c. &c.

asserted that cantharides have the property of colliquating the blood, when mixed with it out of the body, they apprehend that the good effects of blisters in fevers, attended with a glutinosity and lentor in the fluids, arise principally, if not entirely, from their attenuating and dissolving powers. But this theory of the operation of vesicatories is liable, I think, to many objections.

1. If their action depend upon the stimulus of the absorbed cantharides, they should in all cases quicken the contractions of the vascular system. But this is contradicted by experience; for in pleurifies, peripneumonies, and other inflammatory diseases, where the heart and arteries are already acting very strongly, they abate the inflammation and lower the pulse (*a*).

M 3

2. THE

(*a*) Whytts Experiments, Ph. Transact. Vol 50. p. 2.

2. THE small portion of cantharides, which may be carried into the course of circulation by the lymphatics of the skin, cannot I apprehend be adequate to the effects ascribed to it, whether we consider the large mass of fluids with which it is mixed and diluted, or the coats of the vessels lined with a mucus, which must defend them from any slight degree of acrimony. It may indeed be said, that the usual effects of a blister on the urinary passages shew, that the particles of cantharides are absorbed in sufficient quantity, to irritate and vellicate the internal parts of the body. But allowing this objection its full force, by granting what is disputed by some, that the strangury arises from the immediate action of the flies on the urinary passages, this by no means proves their stimulating power, when circulating with the general mass of fluids. All extraneous bodies introduced into the blood, and not capable of being animalized, pass off by one or other of the excretories. If they are of such a
nature

nature as to be volatilized by the common heat of the body, they are eliminated by the lungs, and pores of the skin, along with the matter of insensible perspiration. Garlick, onions, asafætida, sulphur, and most of the essential oils, afford examples of this kind. But if the extraneous matter be less volatile, if it be incapable of chemical mixture with the blood, or if it unite only with the serum, it will be carried to the kidneys, and pass off by urine. Of this nature are cantharides (*a*); and when their acrid particles are, in continual succession, applied to the highly sensible and nervous membrane, which lines the urinary ducts, can we wonder at the strangury, and other painful effects which they produce (*b*).

M 4

3. THE

(*a*) Baglivi on mixing cantharides with the serum of the blood, found the powder precipitated soon after to the bottom of the vessel, without having produced any change in the colour of that fluid.

(*b*) It is not improbable, that the nerves of the urinary passages are disposed to be more irritated by the acrimony of

3. THE same objection may be made to the attenuating power of cantharides, as introduced into the blood by means of blisters. Is it at all probable, that a few grains of cantharides can act so powerfully, as to dissolve a general lentor and viscosity of the whole mass of fluids? Mercury it is true, in a very small quantity, will excite a salivation: But it does not produce this effect, by breaking down the *crasis* of the blood, though the continued use of it may have that tendency, but merely, as I conceive, by its partial stimulus on the salivary glands. An eminent practitioner informed me, that he had more than once ordered blood to be taken from patients under salivation, which he found not in a dissolved, but even in

of the flies, then those which are distributed to the other organs of the body. For Dr. Whytt hath ingeniously proved, that the different operation of medicines, depends very much on the particular nature, and diversified sensibility, of the nerves of different parts of the body; by which they are differently affected by the same kind of stimulating substances.

Vid. Essay on Nerv. Dis.

in a buffy state. But it may be presumed, I think, that cantharides are not possessed, in any considerable degree, of a colliquative power; for they have no chemical relation to the animal fluids, and Dr. Pringle hath proved, that they are by no means septic (*a*). As this, however, is a point of some importance, the two following experiments were repeated after Baglivi, in order to determine it.

EXPERIMENT I.

Four ounces of blood, just drawn from the arm, were divided into two equal portions; to one was added ten grains of *pulv. cantharid.* the other was kept as a standard. The portion with cantharides coagulated at the same time with the standard, and neither assumed a sublivid, nor an ash colour. Its surface was covered with a thin pellicle, but without the vesicles Baglivi describes. After standing a few hours, the crassamentum
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(*a*) Append. to Dis. Army. Exp. 22.

in part dissolved, as appeared from the colour of the serum, which was tinged with red; owing perhaps to a slight degree of agitation, which was used to mix the cantharides with the blood when fresh drawn.

THE portion without the cantharides separated into a clear, pale coloured serum, and a tough, ash coloured crassamentum; the surface of which contracted into the compass of a shilling, and retained that form till the putrefaction begun; which happened sooner in the standard, than in the other portion of blood.

EXPERIMENT II.

TEN grains of *pulv. cantharid.* added to two ounces of serum, tinged with the crassamentum of a light, florid, crimson colour, rendered it more liquid, and changed it to a dull red. Contrary to the assertion of Baglivi, it coagulated with great ease,

ease, and with less heat than an equal portion of the same serum without cantharides.

5. The chief symptoms induced by blisters, may be rationally accounted for, without having recourse to the absorption of the acrid particles of which they are composed. These symptoms are a quick pulse, dryness of the tongue, thirst, strangury, &c. They quicken the pulse in the low state of fevers, by their stimulus on the skin, with which the whole vascular system sympathises. They occasion thirst, dryness of the tongue, and an increase of fever, in the same way, viz. by their external irritation. But these effects ought to be ascribed to the improper and unseasonable use of blisters. When the inflammatory diathesis prevails universally, and strongly, without any partial obstruction, every stimulus must aggravate the symptoms; and blisters raised on the skin, by a cataplasm of mustard, or
by

by the actual or potential cautery, where the irritation is confessedly external, would operate in the same manner as an epispastic of cantharides. But in cases where vesicatories are indicated, I have never found, on the strictest examination, the least increase of thirst, or dryness of the mouth, in consequence of their application (*a*). The strangury has by some

(*a*) The three histories which Baglivi relates of the effects of epispastics, carry very little authority with them; because the blisters were either ill timed, or laid on in too great numbers. The first case is that of a young man, of a bilious temperament, who after being heated, suddenly exposed himself to the cold wind. He was seized with an *angina*, which terminated in a violent pleurisy, attended with the strongest symptoms of inflammation. Six vesicatories were applied at once, to different parts of his body; the consequence of which was, a suppression of the *sputum*, tremors, convulsions, delirium, and death. The second history is that of a cook, who was attacked with a convulsion of the lower jaw, which was soon after succeeded by spasmodic contractions of the abdominal muscles. The *pulvis cornachini* was prescribed, and the next day four blisters were applied. Vomiting, convulsive motions, and an oppressed breathing ensued. On the fourth day he

some been supposed to arise, not from an absorption of cantharides, but from a sympathy between the skin and the urinary passages. And it is urged, that a warm fomentation of milk and water applied to a blistered part, very quickly relieves this complaint, by removing or diminishing the irritation on the surface of the body.

he died. This case was probably a locked jaw; a disease for the most part fatal. The third history is that of a young and slender woman, eight months advanced in pregnancy, who after suffering much pain was at length delivered. The pain however still continued, accompanied with an uncommon tension of the belly. Four blisters were applied at one and the same time, as in the former instances. The *lochia* were immediately suppressed, convulsions came on, and at last the poor patient fell a victim to death.

Baglivius de Vesicant. p. 70.

From the application of so many blisters, it is not to be wondered at, that the thirst, quickness of the pulse, and other symptoms of acute diseases were, according to the experience of Baglivi, greatly aggravated. Besides, it is more than probable, that vesicatories are attended with greater inconveniences in warm, than in cold climates, because the inhabitants of the former are generally of more irritable constitutions, and of more adust and bilious temperaments, than those of the latter.

body. But I confess, the probability lies on the other side of the question ; and several reasons incline me to think, that the strangury is produced alone by the absorption, and internal stimulus of the flies.

1. NEITHER mustard, the actual or potential cautery, nor any other vesicating stimulus but cantharides, excite this complaint. And is it not strange, that the urinary passages should have such a universal sympathy, with all the different parts of the body to which cantharides are applied ; whilst no such consent takes place, when any other vesicatory is made use of ?

2. DRINKING plentifully prevents the strangury ; and surely it can produce this effect in no other way, than by diluting in the kidneys and bladder, the acrimonious particles of the flies.

3. A

3. A BLISTER laid upon the head immediately after shaving, is almost always succeeded by the strangury; whereas no such effect takes place, if the application be delayed twenty four hours. How are we to account for this fact, unless by supposing, that the subtiler parts of the cantharides enter more readily, and in greater quantity into the blood, after the scarf skin hath been removed by the razor? The effect of a warm fomentation, in alleviating the troublesome symptoms of this complaint, arises partly, perhaps, from its sedative operation on the whole system, but chiefly, I imagine, from its washing off all those acrid particles adhering to the skin, which would otherwise enter into the blood, and increase, or at least continue the irritation in the urinary passages.

BUT although it be acknowledged, that the strangury is occasioned by the stimulus of the cantharides, acting internally,
yet

yet the explanation given above of this effect, removes, I think, every objection to what has been advanced. I shall proceed therefore to consider the operation of blisters, according to the division already laid down.

THE diseases of the SOLIDA VIVA, in which they are indicated, are very numerous; but taking a more general view of them, they may perhaps be reduced to three kinds.

1. WHERE THE ACTION OF THE MOVING FIBRES IS EITHER PARTIALLY, OR UNIVERSALLY TOO WEAK.

2. WHERE IT IS IRREGULAR.

3. WHERE IT IS PARTIALLY TOO STRONG.

IN the first case vesicatories are indicated, as a stimulus to the languid solids, to rouse

rouse them to more vigorous contractions, to support the *vis vitæ*, and to promote the salutary secretions. They tend to quicken the circulation, to raise the pulse, and to animate the whole system. Hence we may deduce their use and operation,

I. IN LOW NERVOUS FEVERS; when the spirits sink, when the contractions of the heart grow languid, and the unhappy patient struggles under anxiety, restlessness, delirium, difficulty of breathing, and a load and oppression about the *præcordia*. These symptoms arise from debility, and denote a kind of nervous orgasm, or spasm on the vitals, which requires cordial medicines, aided by the application of blisters (*a*). An eminent practitioner hath indeed observed, that in these fevers, epispastics sometimes aggravate all the symptoms, and by their irritation occasion a small and contracted

N pulse.

(*a*) *Vid.* Huxham on Fevers, p. 82.

pulse. But this he ascribes to a mistake, either in the time, or place of their application. On the first signs of a delirium, when the urine turns pale, when the patient sighs, is anxious, and becomes dull of hearing, or when his eyes sparkle and look staring, &c. he advises to cover the whole head with a blister. The epispastic will thus be applied as near as possible to the part affected; and as the head is less sensible to the stimulus of cantharides, than any other part of the body, all the bad effects arising from too great irritation will be prevented (*a*). Baglivi long ago remarked, that blisters sometimes excite a small and contracted pulse; and I should imagine that in the class of diseases, now under consideration, their utility must always be attended with a peculiar degree of uncertainty. This depends on the nature of these fevers, and the concomitant state of the nerves. Whenever they

(*a*) *Vid.* Med. Essays of Edinburgh, Vol. 4. Art. 23.

they are accompanied with little pain, but with a high degree of irritability, which is not unfrequently the case, blisters, I think, will be found to be prejudicial, by increasing the spasm, and throwing the system into confusion. But if the body, however languid and enfeebled, has been accustomed through the course of the disease, to the stimulus of pain, or if the nerves be not affected with an excess of sympathetic sensibility, epispastics may be applied with safety and advantage.

2. IN the advanced state of INFLAMMATORY FEVERS, when the patient becomes languid, or perhaps comatose, blisters are highly serviceable. And they are found to be very efficacious in removing those obstinate and oppressive head-achs, which have resisted every previous evacuation, and which often continue to the

last period of the distemper (*a*). The same observation holds true in every other species of fever, where such a train of symptoms occur as have been already described.

EVEN in malignant PETECHIAL FEVERS, notwithstanding the great dissolution of the blood, and the supposed tendency of cantharides to increase that dissolution, blisters have been recommended by some of the most eminent practitioners. Thus Riverius says, *Ubi maxima est malignitas, unicum vesicatorium non sufficit, sed plura admovenda sunt; soleo ego in magna morbi sævitia, quinque locis admove, cervici nimirum, utrique brachio, parti interiori inter cubitum et humerum, et utrique femori, parti etiam inferiori inter inguina et genua, cum felici successu* (*b*). Etmuller, treating of the same fevers asserts,

(*a*) Vid. Pringle's Dis. of the Army, p. 134.

(*b*) Riverii Opera, p. 541.

*terts, Si ulla est febris in qua vesicatoria
conveniunt, est imprimis petchialis (a).*

3. IN the SMALL POX ; when the patient is of a lax and weak habit, when the pulse is low, feeble, and depressed, and the fever insufficient for the expulsion and suppuration of the pustules, epispastics are certainly indicated (*b*). When the pocks are of the bloody kind, and attended with delirium, Dr. Mead assures us, that blisters may be used with equal safety and advantage. And in this distemper, whenever the maturation of the pustules does not regularly succeed their eruption, and when anxiety, inquietude, difficulty of breathing, and delirium come on, the fever should be quickened by warm cordial medicines, and especially by the application of blisters (*c*). It is

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always

(*a*) Etmuller. Op. p. 365.

(*b*) Hillary on the small Pox, p. 94. 95.

(*c*) Mead, Sydenham, Morton.

always accounted a bad symptom, when the swelling of the hands does not follow the tumour of the face, and the swelling of the feet that of the hands; and if the patient be threatened with this alarming circumstance, epispastics should be applied to the wrists and ancles, a little before the inflammation of those parts may be expected to begin. For they will not only tend to draw the humours thither, but will give them also a salutary vent (*a*).

4. IN the APOPLEXY. This disease may arise either from the viscosity of the blood, and its too slow circulation, or rather stagnation in the vessels of the brain; or from the transudation of a pituitous lymph, which loads the membranes, and fills the ventricles of that organ, and by that means impedes or totally obstructs its functions. In either of these cases, epispastics may be applied to
the

(*a*) Huxham, p. 155.

the head with great advantage, in order to rouse and stimulate to action the torpid system of nerves. The same may be observed of their utility in the lethargy, and carus, which are lighter species of the apoplexy (*a*).

5. IN the PALSY. When this disease invades the whole body, blisters are useful by their general stimulus. But they are most efficacious when the paralytic affection is not universal, but confined to some particular member or organ. Thus in palsies of the upper extremities, vesicatories applied to the *vertebræ* of the neck, and going obliquely to the shoulder, are remarkably useful. And when the disease attacks the lower extremities, they are equally efficacious, when laid upon the region of the *os sacrum*. In both cases, experience demonstrates that blisters thus applied are much more efficacious,

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cious,

(*a*) Vid Mead, Monita et Præcepta Medica.

cious, than when laid upon the extremities themselves. As most of the nerves which go to the bladder, pass through the *foramina* of the *os sacrum*, vesicatories have been very successfully applied to that region, for the cure of an incontinence of urine. And it is probable, that they would be much more certain and powerful in their operation, if a proper attention was paid, in their external application, to the origin and course of the nerves (*a*).

6. IN a GUTTA SERENA, which sometimes proceeds from a paralytic affection of the retina, would not blisters covering the nerves which issue through the *supra orbital foramen*, and spread themselves on the forehead, be serviceable?

7. IN the TYMPANITES, Celsus advises to make ulcers in several parts of the belly,

(*a*) *Vid.* Lond. Medical Observ. Vol. 2. p. 318.

belly, and to keep them running. But we are furnished by means of epispastics, with a much more effectual, as well as more humane remedy. Dr. Mead recommends their application in this disorder; and it is probable they may do service, both as stimulants and antispasmodics, except where the case is complicated with a mortification of the bowels.

8. IN the RICKETS, Boerhaave recommends blisters, to stimulate the languid vessels, and resolve the mucous concretions.

9. IN SCHIRROUS TUMOURS of the conglobate glands of the neck, blisters applied to the head have a good effect. The finer parts of the cantharides, being absorbed by the lymphatics, are carried immediately to the obstructed glands, and by their stimulus tend to discuss those indolent swellings. If the tumour be seated
in

in the inguinal glands, blisters should be applied to the thighs (*a*).

OTHER diseases, arising from the too weak action of the solids, might be enumerated; but sufficient has been said to prove the efficacy and utility of blisters in such cases.

2. WHERE THE ACTION OF THE MOVING FIBRES IS IRREGULAR, vesicatories are indicated, both as stimulants and antispasmodics.

CONVULSIVE MOTIONS OR SPASMS seem generally to arise from some peculiar irritation of the nervous system. And whether the brain be originally, or only sympathetically affected, whatever rouses and engages the attention of the mind, will seldom fail to afford relief, by lessening, or destroying the sense of that irritation.

Blisters

(*a*) *Monro's Anatomical Lectures.*

Blisters therefore are indicated in such diseases, to stimulate and excite pain in a part of the body that is sound. For according to the aphorism of Hippocrates, *Duobus doloribus simul obortis, non in eodem loco, vehementior obscurat alterum* (a). Dr. Whytt relates the case of a patient, who had an alternate motion of the muscles of the *abdomen*, which was cured by a circular blister, of about eight inches diameter, applied to the part affected (b). The same author acquaints us, that where epilepsies take their rise from an uneasy sensation in some part of the arm or leg, he has found vesicatories, applied to those parts, the most effectual remedies (c).

IN the convulsions which precede the appearance of the small-pox, blisters act as powerful antispasmodics; and they
tend

(a) Lib. 2. Aph. 46

(b) Whytt on Nerv. Dis. p. 460.

(c) Ibid. p. 461.

tend to promote the eruption, both in this disease, and in the measles (*a*). In the idiopathic Epilepsy, the application of vesicatories to the head is recommended by Hoffman, Riverius, Piso, and Mead; who support their recommendation, by many authentic cases and histories. Celsus mentions several remedies for the epilepsy, which are very singular; such as drinking the warm blood of a gladiator just slain, eating human or horses flesh, or the parts of generation of certain animals. If these things had any efficacy, it must arise from the repugnancy of nature to them, and from the strong and painful sensations of mind, which such shocking and disgusting remedies could not fail to excite. Upon the same principle, Boerhaave cured the epileptics in the poor house at Haerlem (*b*).

HOFFMAN relates that he has found
epispastics

(*a*) Cullen's Clinical Lect.

(*b*) See the Account in Kaw Boerhaave.

epispastics of excellent use in the spasmodic asthma (*a*); and Dr. Whytt confirms the testimony of Hoffman by his own experience (*b*).

IN fixed pains of the bowels from spasms, where there are no evident marks of inflammation, the application of blisters to the *abdomen* may be recommended from the authority of Sir John Pringle; who assures us, that he has oftener than once seen a patient relieved in his bowels, as soon as he felt the burning of his skin; and at the same time have stools by a purge, or a clyster, which had not operated before. Hence we may conclude, that blisters act not in such cases as evacuates, but as antispasmodics.

3. WHEN THE ACTION OF THE SOLIDA VIVA IS TOO STRONG.

IT

(*a*) Hoffman de Vesicant.

(*b*) Nerv. Dis. p. 495. Epispastics have also been found to be very serviceable in the *tussis convulsiva*.

Vid. Ridley's Observ. p. 91.

It is yet a subject of dispute amongst physicians, whether epispastics are useful, or detrimental in inflammatory fevers. Hoffman bears the strongest testimony against their application in such cases (a); and Baglivi from his own experience asserts, “*Quod delirantibus cum febre acuta, lingua arida, et indicijs magnæ viscerum inflammationis, si applicentur vesicantia, omnia in pejus ruunt, et magna ex parte moriuntur convulsi* (b)”. Alpinus says, *Nunquam probare potui, in acutis febribus vesicantium usum, quod calorem febrilem augeant, vigilias doloremque concitent, et deliria inducant, coctionem impediant, non minus et motui humorum critico obsint, quum incertus sit locus ad quem, vel per quem crisis est futura*” (c). Sir John Pringle acquaints us, that his first practice in every inflammatory fever was to blister; but afterwards,

(a) De Vesicant. usu. §. 17.

(b) Praxis p. 102.

(c) Medicin. Method. lib. 5. p. 173.

afterwards, when he found that a solution of the fever was not to be procured by such means, he confined the use of epispastics to those states of the disease, in which he could be most assured of their efficacy (*a*). Huxham, if I mistake not, observes that to blister in the beginning of inflammatory fevers is to add fuel to the fire; and Dr. Whytt expressly says, that in fevers, where there is no partial obstruction, or inflammation, vesicatories are of little service, and are sometimes hurtful; unless perhaps towards the end of the disease, when the pulse begins to sink (*b*).

On the other hand Sydenham, whose authority

(*a*) In the second stage of the jail or hospital fever, when the pulse is quick and full, Dr. Pringle hath used blisters, but without success. Nay upon the first attack, the whole head has been blistered, and the oozing kept up for some days, without relieving it, or preventing any of the usual symptoms.

Dis. of the Army, p. 318.

(*b*) Philos. Trans. Vol. 50. pt. 2. p. 578.

authority must have great weight, from his accurate attention to the *juvantia* and *lædientia* in all diseases, adopted the use of blisters in the continued acute fever, which prevailed in the years 1673. 1674. 1675. The symptoms of this fever, as he describes them, indicate a very high degree of inflammation; and his practice was, first to take away a sufficient quantity of blood from the arm, and then to apply a large epispastic to the neck: At the same time he employed the cooling regimen. Dr. Friend says, that in acute fevers, the safest and most speedy relief is afforded by vesicatories. Nor are we to be too scrupulous about accommodating them to the constitution, or state of the patient; for whatever his habit of body may be, if the fever rages beyond measure, the slight inconvenience of a blister is rather to be endured, than the life of the patient endangered; for in these cases, the only hope is in blisters. They derive the febrile matter from the brain, and assist and promote

promote the other discharges, those especially by sweat and urine (*a*). Dr. Glas also, in his learned commentaries, recommends the application of blisters in inflammatory fevers. “*In febris inflammatoriis, post debitam sanguinis missionem, locum habet id remedium; atque licet motus arteriarum, etiamnum nimis veloces, ab eo intenduntur, brevi tantum intervallo id fiet, postea quidem, eliquatis densis humoribus, pulsus sentientur molliores, et febres erunt leniores*” (*b*). “I have more than once in an evening,” says Dr. Lind in his valuable paper on fevers and infection, “ordered eight or ten patients to be blistered, and have left them with a quick pulse, great heat, immoderate thirst, a pain, confusion, and heaviness of the head, and what to a physician conversant with such fevers, communicates a most certain knowledge of the condition of the patient, such a lifeless, sunk state of the eyes,

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as

(*a*) *Vid.* Friend. de Vesicant.

(*b*) Glas Comment. p. 235.

as denoted great danger. But the next morning I found these patients with a lively, brisk eye, a calm pulse, and with a desire to get out of bed " (*a*). Other authorities to the same purpose might be advanced.

How then are we to determine this dispute? May not the truth in this, as in most other litigated points, lie in the middle way between the opposite opinions? If so, the following conclusion may perhaps be justified: That whenever the inflammatory diathesis prevails strongly, and uniformly throughout the system, and no one part is more affected than the rest, vesicatories are pernicious and detrimental. But when peculiar symptoms of inflammation attack the head, the lungs, &c. and prevail more in those parts, than in the rest of the body, blisters are indicated, and often prove remarkably useful. And
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(*a*) Lind on Fevers and Infection, p. 9.

in such cases they are found from experience, to lessen the impetus of the blood upon the vessels of the inflamed part, to abate the fever and heat of the body, and to diminish very remarkably the quickness of the pulse (*a*). Whatever may have been the original cause of a fever, it will be continued, and often greatly increased, by any particular inflammation, which
O 2 may

(*a*) To understand more clearly the action of blisters in such cases, it is necessary to form a just idea of the nature of inflammation, which seems to consist in an increased alternate contraction of the vessels of the part affected. If the inflammation be large, or the part inflamed very sensible, the whole nervous system will be so affected by the pain, as to render the heart and larger arteries more irritable; and the force of the circulation will, of course, be greatly increased through the whole body. This state is what is called the inflammatory diathesis. In the cure of inflammation therefore, two indications are to be attended to; 1. to diminish the force of the circulation in general; 2. to abate the action of the vessels in the part affected. The former is to be attempted by venæsection, and the antiphlogistic regimen; the latter by emollient and sedative applications, and frequently by blistering the neighbouring parts. For the impetus of the fluids, in the vessels of the part to which the vesicatory is applied, is much more augmented in proportion, than the force of the circulation

may happen to have taken rise from it. Under these circumstances, the application of a blister to a neighbouring part, will sometimes produce a resolution of the disease, by lessening the impetus of the fluids on the inflamed part, by making a considerable derivation of serous humours from it, and by rendering the mind less sensible of the painful irritation, which excites and continues the inflammation. Upon these principles, I apprehend, we may easily explain the action, and deduce from them the uses of epispastics in the following diseases.

1. IN the SYMPTOMATIC PHRENITIS
OR DELIRIUM, which accedes indifferently
to the bilious, malignant, or inflammatory
fever. If the lowness of the pulse admits
not

culation in general. And as there seems to be only a certain degree of nervous energy, exerted in the body at one time, the increase of its action in one part, will necessarily diminish it in another. And thus the original inflammation is cured, by exciting another contiguous to it.

not of venæsection, the cure must be attempted by leeches and blisters (*a*). On this subject, Dr. Whytt furnishes us with a practical observation of importance: that in fevers, where the substance of the brain is affected, and not its membranes, he has never found any benefit from the use of blisters. And he always suspects the brain to be affected, when a fever and delirium come on, without any preceding head ach, or redness in the *tunica albuginea* of the eyes. This kind of fever he has met with several times, and has observed it to be generally fatal (*b*). But I have lately had under my care a patient, whose case furnishes an exception to this valuable observation; and as there is something singular and curious in it, it may not perhaps be an useless digression, to give a detail of the most interesting circumstances which attended it

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M. B.

(*a*) *Vid.* Pringle on the Dis. of the Army, p. 138.

(*b*) *Vid.* Phil. Trans. Vol. 50. pt. 2. p. 578.

M. B. a maid servant aged twenty four, being with child, was turned out of her place, and obliged to go into the poor house, where she remained several weeks after her delivery. But sunk with low diet, oppressed with uneasiness, and exhausted with nursing, she was taken back by her friends, who were assisted in their endeavours to recruit and restore her strength, by the charitable benefactions of a neighbouring gentlewoman, distinguished for her humanity. August 12th. 1766, a few days after her return home, she was seized with a fever, which begun with a coldness and shivering, and was succeeded by heat. On the 18th I saw her, and found her in a delirium, with a low and feeble pulse. Her eyes were sunk, but without the least redness or inflammation, nor had she complained of any preceding pain in the head. Her urine was sometimes pale, sometimes high coloured. Her skin had that kind of heat, which is not easily described, but which leaves a disagreeable sensation

sensation in the hand that feels it. Her tongue was dry and blackish; she had a flushing every now and then in her face, and her belly was immoderately loose; and to all these complaints an almost total deafness was added. In the afternoon there was generally a slight remission of the symptoms.

A LARGE blister was ordered to be laid betwixt her shoulders, and the following mixture was prescribed.

R. *Sp. minderer.* ʒiſs. *ſal. c. c.* vol. gr xviii. *tinct. japon.* *tinct. ſerp. virgin.* ana ʒi. *extract. cort. peru.* ʒi. *aq. menth. comm.* ʒij. *ſyrup. cydon.* ʒvi. *m. cap. cochlear.* ij. 2da, quaq. hora.

AUG. 20. The delirium ceased. Her pulse and heat were natural, her looseness was abated, but her deafness still continued. Two blisters were directed to be applied behind her ears.

21. THERE seemed to be no appearance of fever; and the deafness was going off, though the blisters had not been applied. She complained of a numbness in her right leg, which on examination I found to be cold and motionless. Directions were given to rub it well with the flesh brush, and a large cataplasm of mustard and oat meal *ana p. æ.* was ordered to be applied to her foot.

24th. THE palsy was almost removed. In other respects she was well, except the pain occasioned by the cataplasm.

30th. SHE had the perfect use of her leg.

SEPTEMBER. 3d. Though the inflammation occasioned by the cataplasm was very inconsiderable, yet she complained of great pain arising from it. Her foot was therefore fomented with a decoction of chamomile and poppy heads, to which
a suf-

a sufficient quantity of milk was added; and afterwards a white bread poultice was applied to it.

5th. THIS morning she was seized with convulsions of the epileptic kind, and had six fits successively. She was cold, feeble and languid, and complained much of sickness and pain in her head. The following medicines were prescribed.

℞. *Tinct. valerian. volat. tinct. fuliginis, ana ʒss. laud. liquid. gutt. xl. m. cap. cochl. parv. ij. omni hora, ex cyatho aquæ spiritusque vini gallici.*

℞. *Rad. valerian. sylvest. ʒss. aq. fontan. ʒxij. coque parum, et adde asafætid. ʒiss. m. f. enema statim injiciend.*

6th. She was better, and had no return of the fits; but complained still of violent pain in the foot.

7th. SHE

7th. SHE continued free from the fits. Her head was easier, but her foot was still painful. Yesterday in the afternoon, she was suddenly deprived of her sight, without the least previous pain or uneasiness in her eyes. No inflammation, opacity, or alteration of any kind appeared externally; except that the pupils were more than ordinarily dilated. On holding a lighted candle close to her eye, the pupil did not contract itself, and she had not the least perception of the light. As I apprehended her blindness to be a *gutta serena*, arising from a paralytic affection of the retina, I ordered her forehead to be frequently rubbed with the *liniment. volatile*, made with equal quantities of *ol. oliv.* and *sp. salis ammon. cum calce viva*; and afterwards a flannel, moistened with the mixture, to be left upon the part. It was hoped that by this stimulus, applied immediately to the nerves which issue from the eyes, through the *supra orbital foramina*, the retina might be restored to its

its proper sensibility. And the event in some measure answered my expectations; for before night, she was able to distinguish the light of a candle. But the recovery of her sight was both imperfect, and of short continuance.

8th. SHE was still blind, and more stupid and heavy than usual. She was frequently sick, and threw up her food, but refused all medicines. A blister was ordered to be applied to her forehead.

9th. SHE had perfectly recovered her sight. No sooner did the blister begin to operate, but she had a glimmering of light, the pain occasioned a flow of tears, and she was gradually, during the action of the vesicatory, restored to the use of her eyes.

10th. SHE still retained the perfect use of her eyes; was more chearful and lively, had no pain in her head, and complain-
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ed less of her foot. As she seemed to be in a fair way of recovering her former state of health, I left her, after giving the proper directions with respect to her diet.

N. B. THE young woman continued to recover, and about ten days afterwards I saw her perfectly well.

2. IN OPTHALMIAS. Inflammations of the eyes are frequently cured, by making a derivation from the part affected, either by means of leeches or of blisters. Perhaps both might be usefully applied at the same time; the leeches near the external angle of the eye, and the blisters behind the ears; or according to the present more efficacious method of practice, upon the forepart of the head. To conspire with their operation, if the flux of humours to the eyes be great, a brisk purge may be administered, to make a revulsion. And thus I apprehend a cure may be compleated, without draining the whole
body

body by large and repeated venæsections. Hoffman dissuades us from applying epispastics to the neck in ophthalmias. “*In ophthalmia egregij sunt usus; sed observavi, quod in nucha non adeo conducant, sed potius dolor inde augeatur; quum contra pedibus admota, sæpe simulac humor stillare incipit, dolorem levent*” (a).

3. IN NASAL HÆMORRHAGES, blisters applied to the back have been serviceable (b); and may we not from analogy conclude, that they would be equally useful in HÆMOPTOES?

4. IN the INFLAMMATORY ANGINA, Sydenham recommends the application of a large, and strong epispastic between the shoulders, having premised bleeding and purging. Sir John Pringle mentions another remedy, whose mode of operation seems to be similar to that of blisters; viz. the

(a) De Vesicant. usu. §. 12.

(b) Cullen's Clinical Lect.

the application of a piece of flannel to the throat, moistened with two parts of *ol. oliv.* and one of *sp. c. c. vol.* or in such a proportion as the skin will bear. By this means the neck, and sometimes the whole body is put into a sweat. But I imagine it is not by the *diaphoresis*, so much as by the revulsion which it produces, that this application is so efficacious: And upon this principle, perhaps a blister would be still more serviceable. Its operation indeed would not be so quick; but the copious derivation of ferous humours, from vessels nearly connected with the inflamed parts, would much more than balance the comparative slowness of its operation (*a*).

5. IN a true PERIPNEUMONY, especially when the inflammation is great, repeated

(*a*) On looking into the last Edit. of Dr. Pringle's *Dis. of the Army*, I find a note in which he informs us, that in later practice, besides a blister to the back, in bad cases he lays one across the throat: at other times he has applied seven or eight leeches under the *fauces*, p. 173.

peated bleeding is the principal remedy; and Dr. Whytt dissuades us from the early application of blisters. But when the disease is of a mixed kind, when the lungs are not so much inflamed, as loaded with a pituitous matter, when bleeding gives but little relief, when the pulse though quick is small, when the patient is not able to bear evacuations, and the disease hath continued for some time, in such circumstances epispastics will produce remarkably good effects (*a*). Sir John Pringle says that a pleurisy, taken in the beginning, may often be cured by one large bleeding, and a blister laid to the side affected. If there be no particular stitch, but only a general oppression, the vesicatory may be applied to the back, and afterwards if the disease be obstinate, first to one side and then to the other. Whether applied to the chest, or to the extremities, it will relieve the breast, promote

(*a*) Phil. Trans. Vol. 50. pt. 2.

promote expectoration, and lower the pulse. In pulmonic disorders, Huxham recommends blistering the legs; and he observes that when they ulcerate the extremities severely, they commonly give great relief (*a*).

6. IN the SMALL POX, when it is attended with rawness, foreness, and great heat in the mouth and throat, and a sharp rheum or stoppage in the nostrils, blisters are found to be very successful. And in this disease, whenever the *membrana schneideriana* is affected, a revulsion from it is indicated; otherwise towards the close of it, the patient will be in danger of suffocation (*b*).

7th. IN COUGHS, attended with fever, pain in the side, and a pituitous infarction of the lungs, blisters are highly efficacious

(*a*) *Vid.* Essay on Fevers, p. 219. and Obs. de Aere. et Morb. Epid. Vol. 2.

(*b*) *Ib.* p. 140, 149.

cious, in abating the fever, lowering the pulse, and removing the inflammatory obstruction. This Dr. Whytt hath satisfactorily proved, by a detail of cases, laid before the Royal Society, and published in the Philos. Transf. vol. 50.

8th. IN the INFLAMMATION OF THE LIVER, one of the best remedies is a large blister laid over the part affected (*a*).

9th. IN the INFLAMMATION of the STOMACH and INTESTINES, in the ILEUS and INFLAMMATORY COLICK, epispastics are found to be serviceable (*b*).

10th. IN the DYSENTERY, when the pains in the belly are too fixed to yield to fomentations, they are relieved by a blister, applied to the *abdomen* (*c*).

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11th. IN

(*a*) Pringle's Dis. of the Army, p. 151.

(*b*) Ibid.

(*c*) Ibid. p. 202.

11th. IN the RHEUMATISM, SCIATICA, and GOUT, Hoffman commends the use of vesicatories, because they set in motion, and evacuate the supposed acrid matter, which is impacted in the nervous and tendinous parts. Pringle advises their application to the part affected, in the rheumatism and sciatica; and a celebrated Professor at Edinburgh asserts, that they seldom fail of success in the rheumatism, when applied before a swelling of the part comes on (*a*). Huxham also bears testimony in favour of epispastics: “*In crudelissimo rheumatismo, nihil magis prodest quam vesicatoria, inter scapulas superimposita*” (*b*).

THUS much for the action of blisters on the MOVING FIBRES. Their operation on the FLUIDS, depends upon their medicinal powers as attenuants, and evacnants; and these, perhaps, arise solely from

(*a*) Cullen's Clinical Lectures.

(*b*) De Colico Damnoniorum.

from their stimulus on the solids. By quickening the alternate contractions of the vessels, they prevent the stagnation of the juices; hence their attenuating effects: and by exciting an inflammation externally, they occasion a flux of humours to the skin, and a consequent evacuation of them. It seems therefore to be almost unnecessary, to consider vesicatories as belonging to this second class of medicines. But as some interesting particulars, relating to their operation as evacuants, have been omitted in the preceding part of this attempt to investigate their uses, I shall briefly consider them under this head.

I. IN NERVOUS FEVERS, blisters act not only as a stimulus, but as a drain; and they should not be too soon dried up. Huxham says the more they discharge, and the better it is for the patient: and when the first blisters heal up, he recommends the application of others.

2. IN the LYMPHATIC or CRYSTALLINE SMALL POX, vesicatories are recommended as evacuants, both by Huxham and Mead. For by the seasonable discharge of the serosities, the fever, which increases when there is no further derivation of humours to the skin, is happily moderated, if not prevented.

3. IN the WARTY SMALL POX, blisters are very useful evacuants; because the matter being too thick, can neither suppurate, nor pass off by urine (*a*).

4. IN the CONVULSIONS to which children are subject, the best practical writers advise the application of blisters, chiefly on account of the drain which they produce. The plenty of nutrition which nature hath provided for the young animal, from the time of its birth, necessarily creates many redundancies, which
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(*a*) *Vid.* Mead de Variolis.

in a healthy state, are carried off by the glands of the skin, by urine, or by stool. Hence when the infant is arrived to a certain growth, an eruption, called the red gum, usually appears on the surface of the body, and frequently at the same time, there is a discharge from the glands behind the ears, and in the groin. During these excretions, the child for the most part is lively and well; but as the equilibrium of health, in such delicate subjects, is easily disturbed, their continuance is very precarious. And if some new evacuation, be not substituted in the room of them, disease will unavoidably ensue. For so exquisite is the sensibility of the nervous system in children, that a very slight degree of irritation will, in their tender bodies, excite convulsions. In such circumstances, the utility of blisters is obvious, and might be inferred even *à priori*, if experience had not given a sanction to their application. But their good effects are warranted by the most un-

doubted testimonies. And as a proof how salutary it is, to promote the discharge of the superabundant juices in children, Willis relates the case of a girl, who was subject to the epilepsy, and in one of her fits fell into the fire, and burnt her face and forehead in the most shocking manner. The accident however was attended with this good effect, that as long as the ulcers remained open, she was free from the disorder. Hollerius furnishes us with a similar example. A girl had from her infancy a running sore in her head: It was suddenly healed up, and she became epileptic. Variety of remedies were tried to no purpose: Duretus was consulted, who recommended the application of beet leaves to her head, which brought on a large discharge, and removed her epilepsy (*a*). Agreeable to this is the observation of Hippocrates, that running sores of the head happening to children, prevent

(*a*) Boerhaave de Morb. Nerv. p. 820.

prevent the convulsions. “ *Quibuscunque quidem pueris existentibus, erumpunt ulcera in caput, et in aures, ac in reliquum corpus; et qui salivosi fiunt, ac mucosi, hi ipsi in progressu ætatis facillimè degunt: Qui vero mundi sunt, et neque ulcus ullum, neque mucus, neque ulla saliva prodit, neque in uteris purgationem fecerunt, talibus periculum imminet, ut ab hoc morbo (i. e. epilepsia) corripiantur (a).* Dr. Mead, in his learned treatise, *de imperio solis et lunæ*, furnishes us with a very remarkable history of the epilepsy, cured by a discharge from the head, in consequence of the application of a blister. A child about five years old, of a lusty and full habit of body, had convulsions so strong and frequent, that her life was with difficulty saved by evacuates, and other medicines. She continued well for a few days, but was at the full of the moon, again attacked with a most violent fit; after which the dis-

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ease

(a) Hippoc. de Morb. Sacro.

ease regularly kept the same period with the tides. She continued in this state fourteen days, that is, till the next great change of the moon, when a dry scab, the effect of an epispastic with which the whole *occiput* had been covered, broke out, and from the fore issued a considerable quantity of limpid serum. This discharge was promoted by proper applications; and the patient grew up to woman's estate, without ever suffering any return of the dreadful disease under which she had laboured. Celsus in the epilepsy recommends scarification, and the application of cupping glasses to the occiput (*a*); and as this disease frequently arises, especially in children, from plenitude, and a redundancy of humours in the head, a drain made from that part, may justly be regarded as a probable means of cure.

ESSAY.

(*a*) Lib. 3. Cap. 23.

E S S A Y V.

A N I N Q U I R Y

I N T O

T H E R E S E M B L A N C E

B E T W E E N T H E

C H Y L E

A N D

M I L K.

— *Quid tentare nocebit ?*

OVID.

ESSAY V.

AN INQUIRY INTO THE RESEMBLANCE
BETWEEN THE CHYLE AND MILK;
OR AN ATTEMPT TO PROVE THAT
MILK IS THE CHYLE UNASSIMILA-
TED, AND SEPARATED FROM THE
BLOOD, IN NEARLY THE SAME STATE
AS WHEN TAKEN UP BY THE LAC-
TEALS.

THE properties of milk have with
great ingenuity been investigated,
and with equal precision ascertained, by
several medical writers; and if the nature
of the chyle were as well known, the
subject of our present inquiry, would be
obvious and of easy solution. But as this
fluid cannot without great difficulty, be
collected in sufficient quantity, to under-
go an experimental examination, it is
almost

almost impossible to determine its qualities, with any considerable degree of certainty. Nor have I, in a great variety of authors which I have consulted, met with one experiment, which has been made immediately on the chyle, taken from the lacteal vessels. We must therefore content ourselves, with attempting to determine *à priori*, its nature and properties; that by comparing these with the known qualities of milk, some probable conclusions at least may be deduced. And these conclusions may be confirmed by other arguments, drawn from facts and observations.

1. THE chyle must necessarily be composed of the food we take in; which being masticated in the mouth, and mixed with the fermentable saliva, is carried into the stomach, where it receives the addition of the *succus gastricus*, is further broke down, ferments, and passes over the *pylorus* into the *duodenum*. Here it
mixes

mixes with the bile, cystic and hepatic, with the *succus pancreaticus*, and the lymph which is thrown out, from the exhalant arteries, into the intestines. At length, if the animal feed chiefly upon vegetables, it is changed into a white and saccharine fluid, which being imbibed by the lacteals, is carried into the course of circulation, to be further assimilated, animalized, and converted *in succum et sanguinem*.

THE fluid thus formed, in all probability consists of oil, mucilage, water, a coagulable part, and fixed air. That oil and mucilage enter into its composition, may be presumed from the whiteness of its colour; for these two substances, when intimately combined with water, always put on that appearance. The existence of a coagulable part in the chyle, is rather more uncertain; but I think there is some foundation for the hypothesis. Our food is mixed in the *primæ viæ*, with
a con-

a considerable quantity of lymph, which as it is composed of the serum of the blood, must be of a coagulable nature. And the mucilage contained in the aliment itself, possesses also in some degree the same property. So that we may with probability conclude, that the chyle is not destitute of a coagulable part. This coagulable part of the chyle, may possibly owe its origin, as much to the peculiar process of fermentation, which takes place in the *primæ viæ*, as to the animal fluids which are mixed with our food, in its passage through the stomach and small intestines. And this fermentation depends, in a great measure, on the nature of the aliments ingested. For it is observed, that a cow which feeds upon rank and watery grass, yields milk that contains very little *crassamentum*, and is therefore unfit for the purpose of making cheese. That fixed air enters into its composition, is acknowledged by every one, and has lately been very ingeniously

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ly illustrated, by the experiments of Mr. Macbride.

BOERHAAVE and other chemical writers, endeavour to explain the formation of chyle, by the instance of an emulsion, which is made by triturating any of the oleaginous vegetables with water. But the analogy between them is very imperfect, and perhaps only subsists in this single particular, that the white colour of each fluid arises from the mixture of oil and water, by the intervention of mucilage.

2. MILK consists of oil, mucilage, sugar, water, and air. The oil is obtained by a spontaneous separation, and is called cream. The mucilage is that coagulable part of which cheese is made. It has often been compared to the serum of the blood; but differs from it in this essential particular, that it is not coagulated by heat. The water contains a quantity
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of sugar, which may be separated from it, by evaporating with a gentle heat, and crySTALLIZING. That air is present in milk may be made evident to the senses, by placing a quantity of it, previously heated, under the receiver of an air pump.

THE bare enumeration of the above particulars is sufficient to shew, the similitude which subsists between the two animal fluids, which form the subject of our present inquiry. And, if it could be satisfactorily ascertained, that the properties, and component parts of the chyle are justly laid down, this exact resemblance, would prove beyond doubt, that they are one and the same. But, unfortunately, it cannot; and as my conclusion is founded upon hypothesis alone, it is necessary to support it by arguments, drawn from facts and observations.

I. MILK, as to its properties, depends

pende upon the aliment. “ *Pro vi et differentia assumptorum lac diversum esse; ex illis enim chylus melior vel deterior, dulcis vel amarus, ex hoc tale lac; qualia enim ingesta, talis chylus, qualis chylus, tale lac, assertum quotidiana confirmat experientia* ” (a). Dioscorides relates, that the milk of goats which fed on the scammony plant and spurge, proved cathartic; and instances have been known, of an animal yielding bitter milk, from having eaten wormwood (b). If a nurse take a purge, the infant will be purged; if she drink wine or spirituous liquors, it will be intoxicated (c). Milk, and the butter made from it, are found to differ greatly in colour, consistence, taste, and smell, according to the food of the animal. Human milk is made yellow by taking saffron, bitter by wormwood, and impregnated

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with

(a) Crantz M. M. p. 80.

(b) Vid. Lewis's Mat. Med. p. 330.

(c) Vid. Boerhaav. Prælect. §. 690.

with a garlic smell, by eating that root(*a*). Boerhaave relates that thick ale, taken by a fasting nurse, hath in a short space of time been discharged through the breasts (*b*). These instances shew, that milk retains all the adventitious properties of the chyle; we may therefore conclude by analogy, that the natural, and peculiar qualities of that fluid, remain also unchanged.

2. THE milk is proportioned in quantity, to the quantity of chyle. If the animal fast for a long space of time, neither chyle, nor milk is generated. The milk which is secreted immediately after taking in food, is found to be crude and indigested; because it proceeds probably from the juices of the aliment, which are carried into the system by the absorbent vessels, before the chylous fermentation, if that expression be allowable, is perfected.

A nurse

(*a*) *Vid.* Neumann's Chemistry, p. 569. Notes.

(*b*) *Prælect.* §. 688.

A nurse yields the best milk about four hours after a meal; for by that time, the process of digestion is fully compleated. In about eight hours, the chyle begins to be assimilated to the nature of the animal fluids, and then the milk assumes a yellowish colour, and acquires an offensive taste and smell. At length, when the chyle is converted into blood, the secretion from the breast, no longer bears any resemblance to milk, but becomes acrid, fetid, and in every respect the reverse of that mild, sweet, and agreeable fluid.

3. THE saccharine substance, which may be obtained from milk by inspissation and crystallization, and the inflammable spirit, by fermentation and distillation, together with its acedent quality, in which it differs from all the other animal fluids, shew that the vegetable nature of the chyle is unaltered in the vessels of the *mammæ*. (a).

Q 2

4 THAT

(a) If an animal feed upon vegetable diet, the milk will be saccharine and acedent; if upon animal, no sugar will appear

4. THAT the chyle may pass through the course of circulation, without immediately mixing with the animal fluids, appears from the example of water, which is sometimes secreted by the kidneys of hysterical persons, perfectly pure and insipid. And that it really does, is evident from venæsection: for the chyle hath been seen floating on blood, recently drawn from the arm. In the last stage of a diabetes, the urine manifestly points out the presence of chyle in it, by its white colour, saccharine taste, and acescency. If it be kept in a close vessel seven or eight days, it will become sour, and ferment strongly with any of the mild alkaline salts. The learned Baron Van Swieten says, that a milky discharge hath been observed in diarrhæas(*a*). And Mr. Patch,

appear in that fluid, but on the contrary it will be putrescent.

Vid. Young Dissert. Inaug. Cap. viii. p. 55.

(*a*) Van Swieten Comment. §. 1329.

Patch, in the Edinburgh Medical Essays, relates the case of a boy, from whose groin issued, through a small and almost imperceptible orifice, four or five pints of a liquor like milk. (*a*)

5. THE remarkable laxity of the vessels of the *mammæ*, aided by the power of suction, in diminishing the resistance which the fluids might meet with in their passage through them, renders it probable, that the chyle may easily pass into the breasts, and be secreted there unchanged.

6. BUT the following history, which fell under the inspection of a very celebrated physician, and was communicated to me by his friend and correspondent, puts the matter almost beyond dispute. I shall therefore conclude this inquiry with the detail of it. A girl about eight years old, was tapped for an *ascites*. She had also an universal *anasarca*; and even her face was vastly bloated, and ex-

Q 3

ceedingly

(*a*) Edin. Med. Essays, Vol. 5,

ceedingly pale. Four quarts of liquor were drawn off, which was of a milky colour, full as white as milk mixed with an equal quantity of water. It would not coagulate by heat; but after standing a day or two, it was covered with a kind of thin cream, and in a few days more, it smelt and tasted sourish. The girl was greatly relieved by this evacuation; but the tumour of her belly, soon increased again to such a degree, that it was necessary to renew the operation. A liquor the same as before, only somewhat more dilute, was drawn off, the swelling of her whole body subsided, and she recovered her appetite and strength. This girl, before she was attacked with these complaints, was very lively and active, and had a great appetite, in which she was too much indulged. Probably by using violent exercise after a full meal, she had ruptured some of the lacteals.

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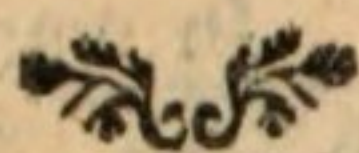
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